Leviton Integrated Networks™
HOME SYSTEM

Installation Manual

for Residential Structured Wiring

Version 2.0

INSTALLATION MANUAL FOR RESIDENTIAL STRUCTURED WIRING

This manual provides a comprehensive description of issues related to the fast evolving subject known as residential structured wiring. It covers industry standards, warranties, installer certification, ordinances, tools, job planning, system design and installation techniques. It was our goal to produce a document which helps the designer or contractor with the entire process of planing and installing a system which is compliant with today's industry standards.

Contact Information

Contact	Function	Phone	Fax
Customer Service	Ordering product	800-323-8920	800-832-9538
Tech Line	Tech support	800-722-2082	425-483-5270
Sales Support	Literature requests	800-922-6229	425-485-0112

Visit us on the web at : www.leviton.com/lin
www.levitonvoicedata.com

Leviton Voice and Data Division: 800-722-2082
Leviton Canada: 800-469-7890
Leviton S.A. de C.V. (Mexico): 525-386-0073

Note: Because Leviton engages in a continuous program of product improvement data in this manual is subject to change without notice.

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TABLE OF CONTENTS

Section — Page No.

1 Introduction to Leviton Integrated Networks Systems

1.1 Structured Media Subsystems **1-2**

1.2 Types of Structured Media Subsystems **1-2**
1.2.1 Essential Infrastructure **1-2**
1.2.2 Enhanced Infrastructure **1-2**
1.2.3 Application Subsystems (Multi-room Video, Multi-Location Stereo, Multi-Location Networking, Family and Home Monitoring) **1-2**

2 Leviton Quality and Warranty

2.0 Quality Statement, Quality Processes, ISO 9000 Leviton Integrated Networks Structured Media™ Warranty **2-1**

3 Certification Policy

3.0 Requirements for Installer Certification, Certification, Certification Checklist **3-1**

4 Local Ordinances, Covenants, and Service Provider Coordination

4.0 Local Ordinance, Covenants and Builder Considerations, Service Provider Coordination **4-1**

5 Recommended Accessories, Tools, and Test Equipment

5.1 Mud Rings Instead of Electrical Boxes for Drop Locations **5-1**

5.2 Cable Routing, Dressing, and Strain Relief **5-1**
5.2.1. Pulling Low-Voltage Wiring Through Wood and Metal Framing Members **5-2**

5.3 Tools for Pre-Wire (Rough-In) Installation **5-3**

5.4 Tools for Trim Out Installation **5-3**

5.5 Termination Equipment for Category 5 or 5e Cable **5-3**

5.6 Termination Equipment for RG-6 and RG-6 Quad Shield Cable **5-4**
5.6.1 Other Tools for Installing Leviton Integrated Network **5-4**

5.7 Test Equipment for Category 5 or 5e Installations **5-4**

5.8 Test Equipment for Telephone Installations **5-5**

5.9 Test Equipment for Coaxial Cable Installations **5-6**

5.10 Check List (of above) **5-6**

5.11 What You Need to Know **5-6**

6 Description of Leviton Integrated Network Systems

6.1 Essential Infrastructure Platform for Single Family Homes **6-1**
6.1.1 Series 280 SMC **6-2**

6.2 Essential Infrastructure Platform for a Multiple Dwelling Unit **6-2**
6.2.1 Series 100 SMC **6-3**
6.2.2 Series 140 SMC **6-3**

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6.3 Enhanced Infrastructure Platform **6-4**
6.3.1 Series 420 SMC **6-4**
6.3.2 Media Versatile Panel **6-4**
6.3.3 Wallplates, Jacks and Connections **6-5**

6.4 Distributed Video (CATV, DSS, other Services) **6-5**
6.4.1 Passive Video Splitters **6-5**
6.4.2 Satellite Signal Distribution **6-5**
6.4.3 Modules with Built-in Amplifiers **6-5**

6.5 Multi-Room Audio/Video Options **6-6**
6.5.1 Stereo Modulator **6-6**
6.5.2 DC Power Distribution Module **6-6**
6.5.3 Multi-Room InfraRed (IR) Repeater **6-7**

6.6 Multi Location Networking **6-7**
6.6.1 10 Base-T Network Hub **6-7**
6.6.2 10/100 Base-T Network Hub **6-8**

6.7 Multi-Room Stereo Sound Application **6-8**
6.7.1 Audio Controls **6-9**
6.7.2 Multi-Room InfraRed (IR) Repeater **6-9**
6.7.3 Speakers **6-9**

6.8 Home Video Security Monitoring **6-10**
6.8.1 Video Sequencer **6-10**
6.8.2 Media Center Modulator **6-11**
6.8.3 RF Notch Filter **6-11**

7 System Design and Placement—Laying Out the Basics

7.1 Laying out the Basics on the Floor Plans **7-1**

7.2 System Choices and Options (Floorplans and Planning Charts) **7-1**

7.3 Mud Ring Locations **7-8**
7.3.1 Location Matrix by Type **7-8**
7.3.2 Number per Room **7-8**
7.3.3 Installation Height above Floor **7-8**

7.4 Cabling Types and Counts for Each Location **7-9**
7.4.1 Telephone and Data Cable: Cat 5 or 5e UTP **7-9**
7.4.2 Video Cable for CATV, TV, DSS, and Monitoring: **7-9**
7.4.3 Power Cable for Video Monitoring Camera: Cat 5 or 5e UTP **7-9**
7.4.4 Speaker Cable for Multi Location Stereo **7-9**
7.4.5 Infrared (IR) Remote Control Target and Emitter Cable **7-10**
7.4.6 Hi-speed Fiber Optic Cable **7-10**
7.4.7 Non-metallic Tubing (ENT and PVC) for Future Cable Runs **7-11**

7.5 Wall Plate Configurations **7-11**
7.5.1 QuickPort Flush-Mount Plates **7-11**
7.5.2 QuickPort Decora Plus WallPlate Inserts and Wallplates **7-12**
7.5.3 Wall Mount Telephones **7-12**

7.6 Structured Media Center **7-12**
7.6.1 General Location **7-12**
7.6.2 Height Above the Floor **7-12**
7.6.3 Horizontal Location **7-12**

7.7 Structured Media Center Components and Devices **7-13**
7.7.1 Recommended Placements of Cables and Components **7-13**

7.8 What You Need to Know **7-13**

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8 Pre-Wire Installation

8.1 The Walk-Through **8-1**
8.1.1 The Reality of the Job and the Installation **8-1**

8.2 Mud Rings **8-2**
8.2.1 Location of Mud Rings **8-2**
8.2.2 Mounting Mud Rings **8-2**

8.3 Structured Media Center **8-2**
8.3.1 Location Matters **8-2**
8.3.2 Mounting Your SMC **8-3**
8.3.3 Grommets or Plastic Bushings **8-4**
8.3.4 Cable Entry to the SMC **8-4**
8.3.5 Powering the SMC **8-4**
8.3.6 AC Power Module **8-4**
8.3.7 Installing the AC Power Module **8-4**
8.3.8 Grounding the SMC **8-6**

8.4 Structured Cabling (Pre-wire) **8-6**
8.4.1 Cable Topology **8-7**
8.4.2 Cable Routing, Dressing and Strain Relief **8-7**
8.4.3 Cable Bend Radius **8-9**
8.4.4 Service Loops **8-9**
8.4.5 Labeling **8-9**
8.4.6 Label Placement **8-9**
8.4.7 Wiring Chart **8-10**

8.5 Pre-Wire for Individual Devices **8-10**

8.6 Volume Control and Speakers Location Considerations **8-11**

8.7 Wiring for the Decora Digital Volume Controls **8-11**

8.8 What You Need to Know **8-11**

8.9 Summary of Installation Rules and Precautions **8-11**
8.9.1 Standard General Practices for Installers **8-13**
8.9.2 Wire and Cable Installation **8-13**

9 Installation Trim Out

9.1 QuickPort Jacks, Connectors, and Wallplates **9-1**
9.1.1 Terminating Cat 5 or 5e Jacks **9-1**
9.1.2 Terminating Coaxial Connectors **9-2**
9.1.3 Terminating at Other Connectors **9-3**
9.1.4 Placing QuickPort Connectors and Jacks into QuickPort Wall Plates **9-3**
9.1.5 Labeling and Label Placement **9-3**

9.2 Structured Media Center Devices (SMC Trim Out) **9-3**
9.2.1 Placing and Mounting Devices **9-3**
9.2.2 Routing and Dressing Cable in the SMC **9-3**

9.3 Essential Infrastructure Platform **9-4**
9.3.1 Basic Telephone Connections Using Bridged Telephone Module **9-4**
9.3.2 Category 5 Voice and Data Module **9-5**
9.3.3 Coaxial Video Distribution Connections Using Passive Splitter **9-5**

9.4 Enhanced Infrastructure **9-6**
9.4.1 Telephone Connections Using Telephone Distribution and Cat 5 Modules **9-6**
9.4.2 Installing the DC Power Supply Module **9-7**

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9.5 Multi-Location Networking **9-8**
9.5.1 Video Distribution (Coaxial) **9-11**

9.6 Multi-Room Stereo Sound Application **9-13**
9.6.1 Multi-Room Considerations **9-13**
9.6.2 Installing and Connecting Analog Volume Controls **9-15**
9.6.3 Setting Impedance for the Leviton Impedance Matching Volume Controls **9-15**
9.6.4 Installing the Decora Digital Volume Controls **9-16**
9.6.5 Preparing the Speakers for Mounting **9-17**
9.6.6 Installing the Speakers **9-17**

9.7 Multi-Room Audio/Video Options **9-17**
9.7.1 Stereo Modulator **9-18**

9.8 Multi-Room Stereo Infra-Red (IR) Control Connection **9-18**
9.8.1 Installing Targets and Emmiters **9-18**

9.9 Indoor/Outdoor Home Camera Monitoring **9-19**
9.9.1 Indoor Security Camera **9-20**
9.9.2 Installing the Decora Camera **9-20**
9.9.3 Mounting the Decora Camera **9-20**
9.9.4 Outdoor Camera **9-21**
9.9.5 Mounting the Outdoor Camera **9-21**
9.9.6 Powering the Cameras **9-21**
9.9.7 Direct Video Monitoring **9-21**
9.9.8 Network Video Monitoring **9-22**

9.10 Multi-Room Video Application **9-27**
9.10.1 Installing Multi-Room Video **9-28**

9.11 What You Need to Know Check List **9-29**

9.12 Terminating the Cable **9-29**

10 Testing and Test Documentation

10.1 Labels **10-1**

10.2 Documentation **10-1**

10.3 Visual Inspection Immediately after Pre-Wire **10-1**

10.4 Basic Testing **10-1**
10.4.1 Cat 5 or 5e UTP in Non-Cat 5 or 5e Compliant Cable Runs **10-2**
10.4.2 Audio Cable **10-3**
10.4.3 RG-6 Quad Shield Cable **10-3**

10.5 Category 5 or 5e Testing **10-3**

10.6 Final Residential Wiring Verification **10-5**

10.7 Speaker Cabling Tests **10-6**

10.8 Documentation of Test Results **10-7**

Appendix A Glossary

Appendix B Frequently Asked Questions

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INTRODUCTION

1 Introduction to Leviton Integrated Networks and Structured Media™ systems

Leviton Integrated Networks purpose.

More than ever, today's technologies are confronting homeowners with an expanded range of choices—and some hard decisions as a result. The three standard television channels of the 1950's and 60's, for example, have exploded into some hundreds of digital cable and satellite options, while the quality of the incoming audio/video signal has evolved to the point where the luxury of a home theater is increasingly considered a standard feature. Home telephone lines are now tied up far longer on the internet than with actual phone conversations, to the point where the phrase *on-line* refers more to a way of life than a connection status. People are considering high-speed access alternatives for their homes which, just a short time ago, were only available to a handful of large corporations.

On top of all these new incoming home technologies, age-old needs such as security, convenience and comfort are raising homeowner expectations in every area. Smarter lighting, better power quality and more comprehensive home control are just some of the applications making the leap from luxury to everyday use.

Since 1906, the name *Leviton* has been synonymous with quality in connectivity. Perfecting the concept of residential wiring devices at the beginning of one century gave Leviton the head start needed to bring today's homes and businesses into the next one. From multimedia panels to surge-protected AC outlets, from three-way lighting to Category 5 or 5e cabling, Leviton's highest level of products, skills and resources are combined in *Leviton Integrated Networks*, an ongoing residential system program that uses the layered subsystem approach to make upgrading simpler and more sensible.

Subsytems for Today's Wired Home

Leviton Integrated Networks start with *Structured Media*™ subsystems designed for those with high expectations for their high technology homes, designed with the flexibility to handle everything from high-speed internet to high-definition TV. From there, *Lighting Control* subsystems set the ambience needed to fully complement today's wired homes. *Home Control* subsystems add comfort, convenience and security by making the home more accessible and livable, as well as making it look more *lived-in*—the first line of defense according to the security experts. *Power Quality* subsystems help to protect the home's technology investment by shielding home offices and entertainment centers from potentially damaging power line problems. Finally, *Special Needs* upgrades give everyone, young and old, easier access in a friendlier living environment.

The different *Leviton Integrated Networks* subsystems have a common baseline that places them a cut above the rest: each component is derived from the more demanding realm of commercial and professional applications. Leviton's data communications products used in *Structured Media*, for example, are considered "high end" in high-speed commercial networks, while the surge-protection components comprising Leviton *Power Quality* are rated for "mission-critical" use in hospitals and laboratories. As standard equipment in high-profile, high-style applications ranging from restaurants to art galleries, Leviton's *Lighting Controls* share an equally impressive set of credentials. The Lighting Control, Home Control, Power Quality, and Special Needs subsytems are covered in other Leviton Documentation. This Installation Manual focuses on the Structured Media subsystems involving voice, data, video, audio, and video monitoring for the home.

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Leviton Integrated Networks presents these most desired home features in pre-configured subsystem packages, with system design, component placement, wiring and installation outlined in easily-followed steps. With the *Leviton Integrated Networks* program, the skilled contractor is positioned as a system integrator, capable of providing their clients with the latest in home technologies and features—all provided and backed by Leviton, the first name their customers trust for their electrical needs. Whether the job calls for a simple upgrade to Category 5 or 5e wiring or a fully-automated networked home, *Leviton Integrated Networks* has the product, system and installation plan needed to ensure success.

1.1 Structured Media™ subsystems.

Structured Media refers to a subsystem that supports the range of information, communication and entertainment technologies available to the modern home—including telephone, high-speed internet, cable and satellite TV (analog and digital), and more. Leviton's Structured Media takes the concept of structured cabling, as practiced in demanding commercial applications for business and office networking, and combines it with multimedia to accommodate the convergence of audio/video and personal computers, of telephone and internet services, and much more.

Most important, Leviton's Structured Media program gives end-users a standards-compliant system—an important consideration today where inadequate or substandard performance may mean a lot more than a call-back. Each properly installed Leviton Structured Media subsystem is designed to meet TIA-570A, the most stringent residential standard proposed by the Telecommunications Industries Association.

1.2 Types of Structured Media subsystems.

Structured Media subsystems can handle needs ranging from cable TV and telephone in several rooms to a Home Area Network (HAN) for a small office or home-based business much like a LAN or Local Area Network. Every Leviton Structured Media subsystem is capable of growing to keep up with the user, with "open architecture" centralized enclosures and wallplates.

Leviton Integrated Networks Systems are built on two primary platforms: Essential Infrastructure and Enhanced Infrastructure. Various applications can be added to these platforms to meet the particular needs of the builder, contractor, and home owner. Each of these applications require additional dedicated pre-wiring.

1.2.1 Essential Infrastructure Platform: this is the base level for residential structured cabling, ideal for builders and end-users who want the marketability and assurance of a Category-rated cabling system and whose needs include telephone and cable TV with the possibility of home networking in the future. This platform includes telephone, data, and video distribution. NOTE: The Leviton Essential infrastructure plan uses the same cabling as the Enhanced plan, and can be easily upgraded.

1.2.2 Enhanced Infrastructure Platform: for homes with multiple PC's, telecommuters working at home, and anyone who may require a network. The Enhanced infrastructure level includes Ethernet for networking PC's and peripherals together as in an office, and provides more room to grow.

1.2.3 Application Subsystems

- **Multi-room Television and Video:** this level application requires additional, dedicated pre-wiring. It allows distribution of video throughout a home on a dedicated wiring platform It can be built on the Enhanced infrastructure level by connecting back to the home entertainment center for sources (CD's, FM, etc.) and amplification.
- **Multi-Location Stereo:** this application or subsystem requires additional, dedicated pre-wiring. It allows distribution of stereo audio to multiple locations throughout the home, with speakers and volume controls in each outfitted location or with Decora Media wallplates that can deliver centralized audio/video content from a source to minisystems and personal electronics (including PC stations) throughout the home.
- **Multi-Location Networking:** this level application will allow two or more PCs on the internet at the same time, and multiple gaming (two or more players on the same connection). It is also popular with families, especially where there is the need to support business, educational and recreational internet use at the same time. Multi-room Internet can also be built onto the Enhanced infrastructure.
- **Family and Home Monitoring:** this level application requires additional, dedicated pre-wiring. It provides several camera options for watching nurseries, backyards and front doors, and other sensitive areas, as well as delivering the picture to televisions throughout the home—on a dedicated "security" channel, or through a video sequencer. Security Video can also be easily built on the Enhanced infrastructure.

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WARRANTY

2 Leviton Quality and Warranty

Quality Statement

"It is our policy to continuously improve the quality of our management systems in order to achieve total customer satisfaction and assure the overall safety, reliability, and performance of our products."

Quality Processes

Leviton quality starts with careful design in engineering, becomes built-in with superior supplier selection and manufacturing, and continues through post sales commitment to providing the best products and customer service possible to you, our contractor/installer customer.

Leviton engineering and manufacturing is ISO9001 certified and our processes are continually improved to enable the highest quality engineering design and manufacturing to bring you high quality products at a reasonable price.

Leviton Integrated Networks components and systems are field proven and reflect many years of experience in demanding commercial, educational-institutional, government, and other high profile applications.

ISO 9000

Leviton is an ISO 9000 Certified Company.

ISO 9000 REGISTERED Quality Manufacturer

2.1 Leviton Integrated Networks Structured Media™ Warranty

Leviton offers a two-part warranty for its Leviton Integrated Networks Structured Media product offerings. The first part is a warranty on Leviton components used in the product line. The second part is an extended warranty, which is only offered for Leviton Integrated Networks Certified Installations that are installed, tested, documented, and registered to Leviton by Leviton certified installers (Program Installation Partners). Please see the Leviton Guidelines for Program Partners necessary to partner in the Certification Program warranty program.

Limited Two-Year Leviton Component Warranty and Exclusions

Leviton warrants to the original consumer purchaser and not for the benefit of anyone else that the Leviton labeled devices, plugs, jacks, connectors, splitters, cables, system media centers, and electronics included as part of a Leviton Integrated Networks residential installation, at the time of its sale by Leviton is free of defects in materials and workmanship under normal and proper use for Two-Years from the purchase date. Leviton's only obligation is to correct such defects by repair or replacement, at its option. If within such two year period the product is returned prepaid, with proof of purchase date, and a description of the problem to Leviton Manufacturing Co., Inc., Attention: Quality Assurance Department, 59-25 Little Neck Parkway, Little Neck, New York 11362-2591. This warranty excludes and there is disclaimed liability for labor for removal of this product or reinstallation. The warranty is void if this product is installed improperly or in an improper environment, overloaded, misused, opened, abused, or altered in any manner, or is not used under normal operating condition or not in accordance with any labels or instructions. There are no other or implied warranties of any kind, including merchantability and fitness for a particular purpose, but if any implied warranty is required by the applicable jurisdiction, the duration of any such implied warranty, including merchantability and fitness for a particular purpose, is limited to two-years. Leviton is not liable for incidental, indirect, special, or consequential damages, including without limitation, damage to, or loss of use of, any equipment, lost sales or profits or delay or failure to perform this warranty obligation. The remedies provided herein are the exclusive remedies under this warranty, whether based on contract, tort or otherwise.

Leviton Integrated Networks Certified System Ten-Year Applications Assurance and Ten-Year Extended Warranty

Leviton's approved Certification Program passive structured cabling products, when properly installed in the Structured Media Center and throughout the residence by Certified Program Installation Partners, with the appropriate category rated cable in strict compliance with Leviton practices and procedures and the electrical performance criteria of the TIA/EIA 570-A standard, will support and conform to EIA/TIA-570-A specifications, covering any current or future application which supports transmission over the Category 5 or 5e cabling links for a period of ten years from the date of certification provided the installation remains as originally installed and certified. In addition, these same Leviton-approved Certification Program products will be free from defects in material and workmanship for a period of Ten Years from date of certification, as long as the products remain installed in the Certification Program System.

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CERTIFICATION

3 Certification Policy

All details for this program are covered in Leviton's "Guidelines for Certification Program Partners". The certification program will help you install the Leviton Integrated Network platforms and application subsystems according to best practices and will enable the homeowner to receive years of problem free service from the completed installation.

Requirements for Installer Certification

To become a certified installer, you must complete a certification training program, pass an examination, and receive a certificate. In addition, your Installation Company must sign a contract agreeing to installation requirements and warranty responsibilities. As part of the program you will learn the function and application of the components and subsystems included in the Leviton Integrated Networks offering. In addition, you will learn the best preferred installation, documentation, testing, and registration practices necessary to complete a Leviton installation. From time to time Leviton will add to the Leviton Integrated Networks product line and will advise you of additional Installation Manual inserts and, if applicable, additional training updates. If you have not received Leviton certification training, please contact your Leviton distributor, or the Leviton Technical Support line at (800)-824-3005 to register for the next available training class in your area.

Certification

Your certificate is proof that you have completed training and have demonstrated satisfactory understanding of the ANSI/TIA/EIA-570A Residential Structured Wiring Standard and Leviton installation, documentation, testing, and registration practices. Use your certificate to indicate to your builder customer that you are a Leviton Integrated Networks certified installer. Many builders will require this certificate.

Certification Checklist

A Leviton Integrated Networks certified installation requires you to follow specific procedures and practices. Please refer to the Guidelines for Certification Program Partners brochure and the practices outlined throughout this manual. The Warranty for you, your builder, and the homeowner, requires that this Certification Checklist is complete at the end of the installation process.

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ORDINANCES

4 Local Ordinances, Covenants, and Service Provider Coordination

Local Ordinances

Local ordinances require adherence to national and local electrical codes when installing AC and, in many instances, low voltage wiring and devices. Make sure you follow all local ordinances and codes when installing a Leviton Integrated Networks system. For example, this manual refers to the use of mud rings instead of electrical boxes for wallplate locations. Your local area may require electrical boxes and conduit for all low voltage wiring. In these cases, be sure to substitute the appropriate type and size of outlet boxes as well as conduit to meet your local ordinances. Remember to use boxes and conduit of sufficient size to accommodate and meet the cable pull, cable fill, and cable service loop requirements listed in Chapters 7 and 8 of this Installation Manual.

Covenants and Builder Considerations

Your local community may have certain covenants that specify location of service entrance and/or demarcation points for CATV, telephone, and other special communications services. External jacks and TV antennae outlets also may be restricted. External satellite antennae, TV antennae, and outdoor speaker locations may be restricted, prohibited, or limited to certain locations in your area or development.

In addition to local covenants, your builder may have design requirements specifying the location of central wiring locations (the location of the Leviton Structured Media™ center (SMC) within the home. Also, the builder may specify the number and location of various wallplates, telephone, data communications, and Community Antenna Television (CATV), Digital Satellite Service (DSS) or television (TV) jacks.

Be sure to check with your builder in order to meet all local covenants and builder specifications during the planning and installation of Leviton Integrated Networks systems.

Service Provider Coordination

The telephone, CATV, and other communications service providers serving your site may have special requirements and services that you should know about prior to planning and installing the Leviton Integrated Networks systems.

Be sure to check on the availability of Integrated Services Digital Networks (ISDN) and Asynchronous Digital Subscriber Line (ADSL or DSL) services from the local telephone service provider(s). Availability of these services will dictate the number of Category 5 or 5e cables from the demarcation point to the SMC, the type of components in the SMC, and certain wallplate configurations within the home. Your builder may specify certain Leviton Integrated Network packages based on the availability of these services.

Alarm Security services may also have a service demarcation point separate from normal telephone service. Please check with the builder if any such services will be offered.

CATV may or may not be offered in your building area. If not available immediately, CATV service is often added at a future date and the wiring plan should provide for CATV service from a demarcation point into the house.

Please check with the CATV provider to determine the number of service entrance cables you will need. In some communities, two or more cables may be required to offer alternative CATV services, or to provide an increased number of cable channels. You must duplicate the number of required cables from the CATV demarcation point to the SMC and to the CATV jacks in the home. Typically, the CATV provider will provide a

(continued on pg. 4-3)

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IMPORTANT SAFETY AND INSTALLATION INFORMATION FOR ALL TELECOMMUNICATIONS APPLICATIONS

There are special safety considerations with telephone wiring that may be unknown by workers new to this field. The following hints and guidelines should be followed closely to help avoid safety hazards, and ensure trouble-free installations and high-quality telephone service.

This publication cannot, however, cover every aspect of safe installation and connection of telephone wiring. The contractor must follow local code requirements, including Article 800 of the National Electrical Code, and all rules or suggestions of the local telephone company and/or governmental and other regulatory agencies.

HIGH VOLTAGE SAFETY TEST: EXPERIENCED ELECTRICIANS, AT FIRST CONTACT, ALWAYS ASSUME THAT HAZARDOUS VOLTAGES MAY EXIST IN ANY WIRING SYSTEM.

A SAFETY CHECK, USING A KNOWN, RELIABLE VOLTAGE MEASUREMENT OR DETECTION DEVICE, SHOULD BE MADE IMMEDIATELY BEFORE WORK IS STARTED AND WHENEVER WORK IS RESUMED ON ANY JOB.

Heart Pacemakers

Never attempt repair, installation, or modification of telephone equipment or wiring systems if you wear a pacemaker. Pacemakers can be disrupted by telephone-circuit voltages and ringing-cycle frequencies.

Lightning and High-Voltage Danger

Most electrical injuries involving telephone wiring result from sudden, unexpected high voltages on normally low-voltage wiring. Installers may relax their normal care when handling telephone wire because it is a low-voltage system. However, telephone wiring can carry hazardous high voltages under certain unsafe conditions.

Never install or connect telephone wiring during electrical storms. Improperly protected telephone wiring can carry a fatal lightning surge for many miles.

Lightning exposure can also be a danger to telephone users. Therefore, jacks should never be installed in a position that would allow telephone use by a person while in a bathtub, hot tub, or swimming pool.

All outside wiring must be equipped with properly grounded and listed signal circuit protectors. These protectors must be installed in compliance with the requirements of the local telephone company and applicable codes. Do not remove or modify protectors or the grounding wire placed by the telephone company. Connections to telephone company independent grounding systems can be made only with the approval of the local telephone company.

Do not run open wiring between structures where it may be exposed to lightning without proper protection. Avoid wiring in or near damp locations.

Wire Separations

Telephone wiring systems must be installed to minimize the possibility of accidental contact with hazardous power and lighting wiring. Never place telephone wiring near bare power wires or lightning rods, antennas, transformers, steam or hot water pipes, or heating ducts. Never place telephone wire in any conduit, box, channel, duct, or other enclosure containing power or lighting circuits of any type. Always provide adequate separation of telephone wiring and other electrical wiring according to code.

When in doubt about separation distances, the “Rule of Sixes” can be used. This rule requires six feet of separation between telephone wiring and open high-voltage wiring, lightning grounding wire or grounding rods. It requires six inches of separation from all other high-voltage wiring unless in conduit.

Avoiding Shocks

Fifty (50) to sixty (60) volts DC is normally present on an idle tip-and-ring pair. Ninety (90) volt AC ringing current can deliver a very uncomfortable shock under certain circumstances. Consequently, always use insulated tools and avoid all contact with bare terminals and grounded surfaces.

To avoid being shocked, always disconnect the dialtone service from the premise wiring while working. If you cannot disconnect, take the telephone handset (receiver) off hook. The DC level will drop and normally no AC ringing current will be delivered. (Be sure to replace the handset when work is completed.)

Metallic Surfaces

Special caution is required when running telephone wire on or near metallic siding. Always check for stray voltages present on any metallic surfaces.

Cutting and Drilling

Always observe trade safety rules for concealed wiring. Be extremely careful not to cut through or drill into concealed wiring or pipes. Make a small inspection opening before cutting or drilling.

Splicing

Common wire-splicing techniques may cause the wire to break and result in poor circuit integrity. This can cause interference in the form of static and noise on the line.

Clean Contacts

Dust or dirt can cause special problems on telephone wiring contacts. Be sure all contacts are clean and that all parts are installed correctly to protect them from dust and dirt.

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signal level of 0 dBmV to 15 dBmV. The signal level at the demarcation point will dictate whether a video amplifier is required prior to video splitters.

If CATV is available, check to see if cable modems are available for high-speed internet access. Some cable modem providers want a direct run from the CATV demarcation point to the location of the cable modem.

A TV antenna and/or DSS antenna and provision for DSS distribution throughout the home from the SMC is not just an alternative to CATV. Your planning and installation should include provisions for DSS even though CATV is available. Many homeowners want either an alternative to CATV, or both CATV and DSS services. HDTV reception may also need to be concidered. The DSS antenna may require one, two, or four RG-6 quad shielded cables to the SMC, and from there to DSS receiver locations. Most RG-6 quad shield cables for video and TV distribution within the home use a copper clad steel core to provide optimum video signal performance and cable strength. But for the coaxial cable that connects the satellite antenna to the satellite receiver, many DSS manufacturers recommend solid copper core RG-6 quad shield because the cable must carry power (voltage switching) to switch LNBs at the antenna. Make sure you understand the requirements for your installation. Also, a telephone jack is required at each DSS receiver location. An off-air TV antenna may require one or two cables to the SMC and from there to TV locations. Please note the possible covenant restrictions on antennae locations in 4.2 above. When planning external antennae or satellite dishes, make sure to take all necessary grounding, mounting, and lightning protection precautions that may be required in your region.

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ACCESSORIES

5 Recommended Accessories, Tools, and Test Equipment

An installer with the highest skill level can't make up for inferior equipment or tools. The old adage about using the right tools for the job certainly applies to installing the structured cable and components that make up modern day data, telephone, and media networks. Leviton provides the best and most appropriate tools for category-rated connectivity systems, tools that in turn help the installer to do a superior job. Not only will your work be easier to perform, but also you and your customers are more assured of full system integrity.

After the system is installed, the next step is testing the cable runs. The testing equipment recommended by Leviton will help you quickly isolate common wiring faults and inadvertent wire damage sometimes caused by other trades on the job. This section will cover the recommended installation and testing tools as well as accessories to secure your cable as you route it throughout the job.

5.1 Mud Rings Instead of Electrical Boxes for Drop Locations

Unlike standard AC wiring, low-voltage wiring on its own does not require any type of outlet box. *An AC device that supplies power to low-voltage wiring, such as an Leviton's AC Power Module, will always be housed in a box as per the NEC. An unrelated AC device, such as a switch, can also share a box with low-voltage wiring (not a preferred practice) provided there is a physical, metal separator between the two devices.*

Leviton recommends a mud ring instead of electrical boxes for the low voltage wiring when allowed by local codes. Using a standard mud ring at the termination point of low-voltage wiring offers two immediate advantages:

- It allows more room for space consuming devices such as a security camera and connection points
- It permits the installer to leave a long cable service loop or (spare cable) inside the stud cavity
- It makes it easier to maintain minimum cable bend radii behind the wallplate

Installer Tip: Leviton recommends that you leave a 36 inch service loop for fiber optic cable and a 24 inch service loop for all other cable. This gives you plenty of spare cable to correct wiring errors and for future expansion should the end device need changing.

A mud ring, like a standard outlet box, provides a sturdy surface for attaching a device or cover plate. Mud rings are available for both new construction and remodeling in existing walls.

5.2 Cable Routing, Dressing, and Strain Relief

Unshielded twisted-pair (UTP) cable, such as Category 5 or 5e, which features prominently in this publication, is manufactured to deliver high-speed performance to multiple end points. UTP cable does its job best when its handled appropriately. This is not a forgiving material that can be pulled, stretched, and stapled the same way as standard romex. A light touch on the installer's part goes a long way towards guaranteeing system integrity and performance. Leviton recommends the following materials for cable installations:

- J-hooks and similar cable supports instead of staples for supporting cable along joists
- Cable clamps on individual cable runs
- Velcro, tie wraps and cable straps for wrapping multiple cables and for securing cable to studs (Leviton SoftCinch, or equivalent)
- Leviton Cable Joe, Clamp-on Cable Router for smoothly routing up to 20 cables around corners without damage

Standard staples are not recommended. The methods recommended here are more forgiving. The cost of time spent tracing down and replacing one damaged cable will surpass any lower material expense or labor cost saved by using less expensive staples.

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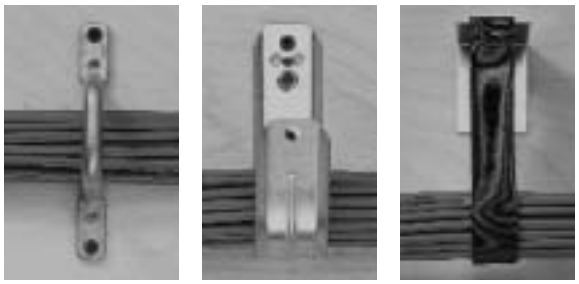
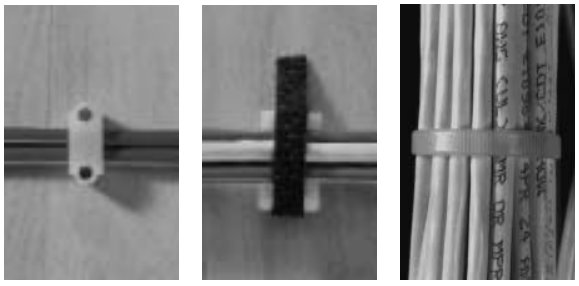
Installer's Tip: An insulated staple is an ideal fastener for low-voltage wiring. The insulation acts as a built-in stop that prevents the staple from crushing or stressing the cables. Be sure the cable diameter does not exceed the staple's capacity.



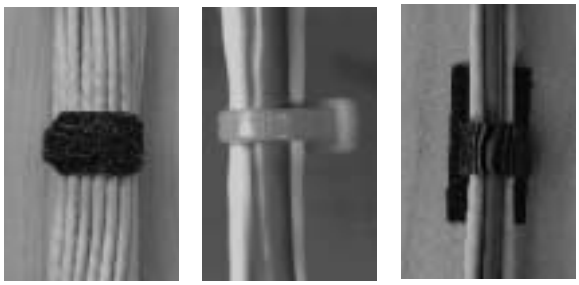
Use j-hooks or similar devices designed to support cables.



Staples by hand, or use staplers with depth stops.

Use Velcro® to keep cables from becoming over-cinched.

Use tie wraps loosely on large bundles. (See 'Using Tie-wraps')



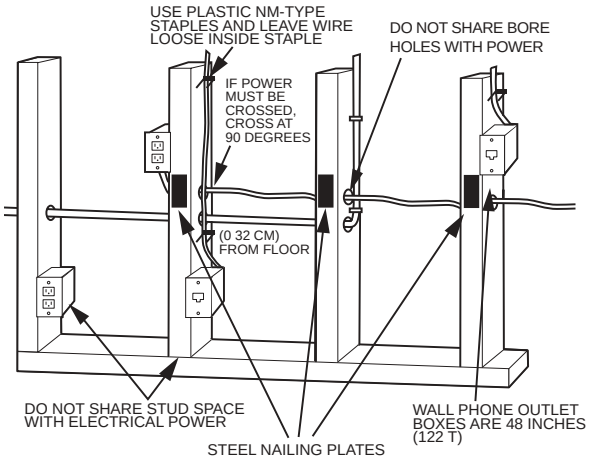
Use Velcro® tie wraps and cable straps to secure large bundles.

5.2.1 Pulling Low-Voltage Wiring Through Wood and Metal Framing Members

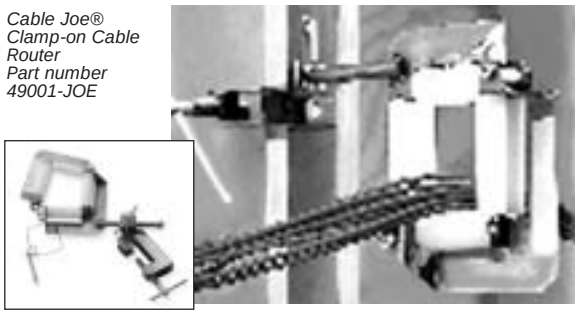
Like standard AC cable, low-voltage wiring will run through holes in wall studs, floor joists, and rafters. Although NEC rulings for protecting electrical cable apply to AC conductors, structured cable systems can be protected the same way. These rulings state:

- Cable running through framing members must be 1 1/4" or further from the nearest edge of that framing member (Section 300-4[a][1] and [2])
- If a cable cannot meet the 1 1/4" rule, it must be protected by a steel nailing plate attached to the edge of the framing member
- Cable running in intermediate and rigid metal conduit, rigid nonmetallic conduit, and electrical metallic tubing is exempt from the 1 1/4" rule
- Cable running through metal framing members must be protected by a bushing or grommet unless the cable is running inside conduit

A single low-voltage cable running through a stud hole is unlikely to get damaged by a drywall nail or screw, but a bundle of cables would certainly be subject to damage. For the cost of some nailing plates, the nuisance and expense of replacing a damaged low-voltage wire inside a finished wall can be avoided.



Cable Joe® Clamp-on Cable Router Part number 49001-JOE



Cable Joe® Clamp-on Cable Router

The best solution available for pulling cables around corners.

- Saves time and money by preventing cable damage, and allowing more effective use of installation personnel.
- Mounts onto any surface: trays, joists, or lag bolts to walls.
- Routes up to 20 cables at once–even around 90° angles.

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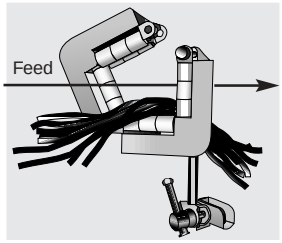
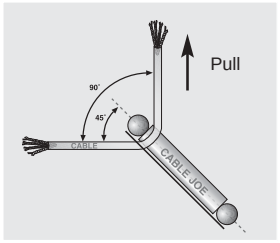
- Made of heavy duty 12 gauge cold rolled steel with 6-roller design to pull cables smoothly and easily.
- Opens simply and closes securely with quick-release pin.

Cable Joe® Application and Use

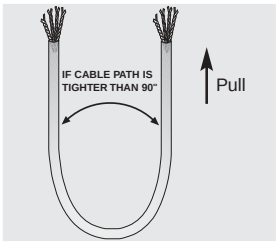
Position Cable Joe so that cables run at the widest angle possible. This will preserve cable bend radius.



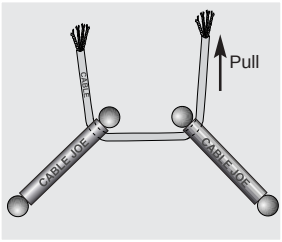
Clamp or screw to stable structure. Close and set latch before pulling cable.



When running cable around a 90˚ corner, place Cable Joe at an angle, so that cable runs smoothly through rollers.



If cable is being run around an angle that is tighter than 90˚...



...use two Cable Joes to relieve cable stress.

5.3 Tools for Pre-Wire (Rough-in) Installation

The following list includes tools normally found useful in the pre-wire or rough-in stage of installation.

- Labels (for labeling cable)
- Drill
- Drill bits (assorted)
- Extension power cords
- Screw driver set (regular and philips)
- Pliers
- Hammer
- Wire snips or wire cutters
- Wire fasteners for Category 5 or 5e and RG-6 quad shield cable
- Measuring tape
- Level (6”)
- Punch (for steel studs)
- Grommets (for steel studs)
- Tape (electrical and other)
- Cable Joe™
- Permanent marker
- Flashlight
- Ladder
- Broom and dust pan

5.4 Tools for Trim Out Installation

(see test section for test tools and other sections for more detailed information)

- Labels (for labeling cable)
- Electric drill
- Drill bits (assorted)
- Extension power cords
- Screw driver set (regular and philips)
- Pliers
- Hammer
- Keyhole drywall saw
- Wire snips or wire cutters
- Category 5 or 5e UTP stripper
- Impact/Punchdown tool with 110 bit and blade
- RG-6 quad shield coax stripper
- RG-6 quad shield coax F-connector crimper
- 6- and 8-position telephone and Category 5 or 5e plug crimp tool
- Leviton coaster for Category 5 or 5e jack termination
- Utility knife
- Fish tape
- Level (6”)
- Flashlight
- Ladder
- Broom and dust pan

5.5 Termination Equipment for Category 5 or 5e Cable

Good, clean jacket removal and termination assures that every wire connection is made with full contact between the wire end and its termination point. This technique results is in a high quality connection that cannot be obtained when a wire is nicked or poorly stripped. Leviton offers several termination tools for Category 5 or 5e cable including:

- UTP Jacket Stripping Tool
- Jack Termination Tool
- D814 Wire Punchdown/Termination Tool (and D814 Tool Blades)

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The Wire Punchdown Termination Tool presses wire conductors into place in Insulation Displacement Connectors (IDCs) and in QuickPort modular snap-in jacks. It will also trim off the ends of the wire conductors. The Wire Punchdown/Termination Tool assures solid connections on an array of wire termination blocks. A push on the tool's handle and one of its five interchangeable blades will easily terminate 22, 24, or 26 gauge solid wire into 110 style IDC punch downs as found on Leviton Category 5 or 5e jacks, Category 5 or 5e Modules, and other Leviton modules.

Using Wire Punchdown Termination Tool on Leviton Cat 5 or 5e jack

Installer's Tip: Category 5 or 5 e cable requires precise termination. Removing too much insulation can adversely affect the efficiency of the cable. Tools manufactured specifically for trimming low-voltage cable will work more precisely than knives or diagonal cutters.

EIA/TIA-570 standards recommend the use of 8-conductor jacks only with a T568A wiring pattern on the outlet end. Leviton recommends one of the following three terminations on the distribution end of Category 5 or 5e cable:

- Category 5 or 5e Module or patch block (or patch panel)
- Individual Category 5 or 5e jacks mounted in a housing, bracket, or panel with T568A wiring
- Unbridged 1x9 Bridged Telephone Module

5.6 Termination Equipment for RG-6 and RG-6 Quad Shield Cable

The recommended terminations for video (broadband) wiring is a compression lock or a crimp male F-type connector at both ends of the cable. A high-quality push-on F-fitting can be used as well, but if you have any questions about its integrity, use a compression lock or a crimp style instead. The small amount of extra installation effort will pay off in the end.

Leviton recommends a high quality, commercial grade coax stripping tool (e.g., Leviton C5914) for stripping all RG-6 quad shield cable and a comparable crimping or compression tool for assembling the connector (note: the type of tool will depend on the style of F connector used).

Leviton offers coaxial Stripping Tools for one-step stripping of RG-6 quad shield cable

UTP Stripper

Coax Stripper

5.6.1. Other Tools for Installing Leviton Integrated Networks

Installing structured cabling requires some of the standard tools that every electrician and installer carries, including:

- Wire cutters
- Large and small screwdrivers (both slotted and Phillips)
- Drill and a variety of drill bits

Aside from the specific tools listed above, the following will also be needed to do a proper installation:

- Special coax wire cutters that keep the cable round when cutting
- A set of small screwdrivers for installing terminal strips and connecting wire to binding posts in the system
- A modular plug crimping tool for putting plugs on Category 5 or 5e cable
- A good quality labeling tool

5.7 Test Equipment for Category 5 or 5e Installations

Category 5 or 5e cable should be inspected throughout its installation. This is much easier than trying to trace down a problem later within a bundle of cables.

Good testing equipment will:

- Help keep your installation Category 5 or 5e compliant
- Find any errors or disruptions
- Point out problems in your installation techniques so they can be corrected
- Adds value to your installation, to the builder, and to the homeowner
- Make it possible to provide the Leviton extended warranty on installation

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When field-testing Category 5 or 5e cable installed for data transmission:

- Use a Category 5 or 5e field test set, following the manufacturer's instructions
- Use a Category 5 or 5e field test set for testing all Category 5 or 5e cable, respectively, installed for data transmission. Select a test set from one of the listed, or other reputable manufacturer and follow the manufacturer's instructions.
- Only those cable runs with Category 5 or 5e jacks available on both ends of the run (wallplate Category 5 or 5e jack and Cat 5 Module at the SMC end) can be tested for Category 5 or 5e compliance.

5.8 Test Equipment for Telephone Installations

Leviton and other suppliers manufacture equipment for testing low voltage wiring. Two key instruments from Leviton are the Tone Test Set and the Inductive Speaker Probe. Used together, these instruments will:

- Locate individual wires in a horizontal run along with any breaks or terminations that might be present
- Test for continuity
- Check for shorts and opens
- Identify Tip and Ring polarity
- Identify the line condition for CLEAR LINE with dial tone, BUSY LINE and RINGING LINE

Cable Testers - Manufacturer Listing

The following companies manufacture hand-held cable testers. This information is listed as a courtesy for your reference only and is not an endorsement nor a recommendation. You are advised to contact each company directly to request detailed information about each product. Some of these companies also sell their product through other companies under other product names; you are advised to ask which of these companies is the actual manufacturer of the tester.

Agilent Technologies

753 Forrest Street
Marlborough, MA 01752
800-418-7111
508-486-0400
Fax: 508-786-9700
www.scope.com
sales@scope.com

Product

Wirescope 155 Cable Analyzer , WireScope 350 Fiber SmartProbe+

Datacom Textron

11001 31st Place West
Everett, WA 98204
800-468-5557
425-355-0590
Fax: 425-290-1600
www.datacom.textron.com

Product

LANcat® Installer Cable Tester, LANcat® System 5 Cable Tester and Talk Set, Optical Loss Measuring System LANcat® System 6 Cable Tester and Talk Set, FIBERcat(tm), NXT Network Test

Fluke Corporation

6920 Seaway Blvd, PO Box 9090
Everett, WA 98206
800-44-FLUKE (Customer Support)
www.fluke.com/nettools/

Product

DSP-100 CableMeter, DSP-100/SR Cable Meter DSP-2000 CableAnalyzer, DSP-FTK Fiber Test Kit (MM), LS-1310/1550 Fiber Test Kit (SM), Fluke 140 Tone Probe & Fluke 620 LAN Cable Meter DSP 4000v

Wavetek Wandel Goltermann

1030 Swabia Ct.
Research Triangle Park, NC,
27709-9441
800-729-9441
www.wwgsolutions.com
sales@wwgsolutions.com

Product

LT 8000, LT 8100, LT 8155LT 8000, LT 8100, LT 8155, 8600, 8600TSP & Fiber Test

Unshielded Twisted Pair (UTP) cable used in non-category rated applications, coaxial cable, and other cable:

Microtest, Inc.

4747 North 22nd Street
Phoenix, AZ 85016-4708
800-526-9675
602-952-6400
Fax: 602-952-6401
www.microtest.com
sales@microtest.com

Product

MicroScanner, Microscanner Pro, PentaScanner 350, OmniScanner 2, OmniFiber, CertiFiber

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The low-cost Tone Test Set can test for all types of wire applications including telephone, data, CATV, HVAC systems, and security/fire alarms. Results are shown on an easy-to-read LED display. Telco standard 6A-type alligator clips with piercing pins securely grip 66-clips, screw heads, screw bodies, and wire-wrapped of threaded terminals, allowing testing of all types of configurations. A 6-position, 2-conductor plug lead is also provided for connection to modular jacks.

Installer's Tip: Cable should be tested regularly during installation so any problems can be repaired early in the job.

The Inductive Speaker Probe, used in combination with the Tone Test Set, readily detects audible frequency tones so wires, cables, and metallic circuits can be traced and identified without damage to their installation. The Inductive Speaker Probe's duckbill and needlepoint tips provide great flexibility for inspecting wiring in tight spots, cables under tension, or larger cable bundles. A built-in speaker eliminates the need for a buttset (in noisy environments, a buttset can be attached to the probe's connecting tabs).

Leviton's Craftsperson's Handset performs all the standard buttset line tests such as polarity check, line monitoring, and signaling. It is line-powered and provides both DTMF (Touch Tone) and dial pulse output.

A Modular Plug Breakout Adapter serves to breakout individual conductors when connected to a Category 5 or 5e jack.

5.9 Test Equipment for Coaxial Cable Installations

Coax cable can be tested for breaks in the cable itself and for cable resistance. Breaks can be checked using a multimeter or coax cable tester. The multimeter also checks for resistance.

Installer's Tip: Using two-way radios during testing will easily allow the installers to talk with each other during testing.

Some cable testers for telephone applications, such as the TelScout® TS100 from Textronix, Inc., the MicroScanner™ and MicroScanner Pro™ from Microtest, Inc., and the ShortStop™ from JTE, offer non-category rated twisted pair as well as coax testing in a single unit, enabling you to find faults in coaxial cables. Coax testers check for continuity and shorts and some of the testers, like the MicroScanner and the ShortStop also include a TDR feature for determining length of the cable run.twisted pair and coax testing in a single unit, enabling you to locate faults in coaxial cables. Coax testers check for continuity and opens or shorts in multiple and single runs of coax. A signal level analyzer is a necessary tool for measuring TV signals coming into a house and for video verification.

Inductive Speaker Probe

Tone Test Set

Craftsperson's Handset (Buttset)

Modular Plug Breakout Adapter

5.10 Check List

Accessories and Tools

Objective	Use This
Termination point	Mud ring
Cable routing & support	J-hooks, cable clamps, Velcro® tie wraps cable straps, Cable Joe® Clamp-on Cable Router
Category 5 or 5e cable cutting tools	UTP Stripping Tool, D814 110 Wire Punchdown/Termination Tool
Category 5 or 5e cable termination	1x9 Bridged Telephone Module; Cat 5 Voice and Data Module; Category 5 or 5e jacks
Coax cable cutting tools	Coaxial Stripping Tool; Coaxial Crimping or compression Tool, Coaxial Cable cutter

5.11 What You Need to Know

Mud rings are ideal termination hardware for low-voltage wiring.

Structured wiring is not as hardy a material medium as standard AC cable; it must be carefully supported and routed so the cable integrity stays intact.

Specific testing and termination tools for low-voltage wiring help assure a clean, trouble-free installation.

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6 Description of the Leviton Integrated Networks Structured Media™ System

The *Leviton Integrated Networks* are composed of a series of smaller subsystems. This manual explains the installation of the *Structured Media* subsystem as described in Section 1. The *Structured Media* subsystem covers all of your customer's data, telephone, and entertainment needs. This subsystem or infrastructure comes with the following:

- A *Structured Media Center* or centralized distribution panel
- Modules for information, telephone, and entertainment end use devices
- Stylish wallplates with snap-in jacks and connectors at the points of termination

You can add application modules to the infrastructure platforms to address multi-room stereo sound from an entertainment center, home monitoring video cameras, and other applications.

The *Leviton Integrated Networks* Structured Media subsystem starts with a Structured Media Center or SMC as a housing and distribution center. Within each SMC are various modules or origination points for your structured cabling.

There are two platforms for the *Leviton Integrated Networks Structured Media* subsystems:

1.The *Essential Infrastructure Platform*

2.The *Enhanced Infrastructure Platform*

Note: Depending on a particular builder's or remodeler's marketing plan, other terms may be used to describe the different Leviton Platforms (such as Advanced, Basic, etc.).

The *Essential Infrastructure* platform is the base level for structured cabling. It provides telephone, video, and data functions with the assurance of Category-rated cabling in a single, low-cost package. This platform is coupled with different SMCs for the following building types:

1. Single family

2. Multiple dwelling unit (MDU)

The *Enhanced Infrastructure* platform uses a larger SMC that allows for the following:

- More telephone, video, and data terminations than the *Essential Infrastructure Platform*
- Home network (Ethernet) capability
- Room for expansion

Installer's Tip: The future will be filled with more low voltage appliances and devices, not fewer. Keep expansion in mind when you and your customer discuss the system installation.

6.1 The Essential Infrastructure Platform for Single-Family Homes

Leviton's Essential Infrastructure platform offers the following three SMCs for a carrying ability of up to twelve different distribution modules:

1. SMC 280 (28" Panel)

2. SMC 100 (14" Panel for multi dwelling units)

3. SMC 140 (14 " Panel)

It is important to size the SMC accurately to your job specifications. Several factors will influence the complexity of your structured cabling installations including:

- The size of the dwelling
- The requirements of your customer
- Your job budget

Take Note: The SMC platform is a consolidation panel for low-voltage wiring. All your points of origination are neatly and safely contained in one protected box. Leviton offers four types of SMCs in three sizes that can handle even the most elaborate residential installations and meet a full range of budgets. An open architecture *Media Versatile™ Panel* is available for custom retrofit and remodel jobs.

Leviton makes your work easier by offering *Pre-Configured Structured Cabling Panels* that are assembled from the most popular distribution modules. These are your system's basic building blocks. The panels and modules can be combined easily to meet any job's specifications.

These panels include combinations of the following modules:

- 1 x 9 *Bridged Telephone Module* bridges up to four telephone lines and out to nine telephone jacks (Please note that bridged telephone connections are for voice only and do not conform to the TIA-570-A standard for Category 5 or 5e data wiring; these bridged telephone lines cannot be tested for Category 5 or 5e compliance using Category 5 or 5e field test sets.

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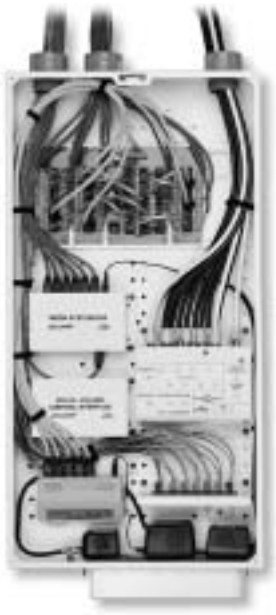
- *Category 5 Voice and Data Module* whose six Category 5 or 5e ports allow for basic home networking (data, phone, fax or modem) and can be connected to a *Telephone Distribution Module,* key system, or network hub
- 1X6 *Video Splitter* that is suitable for both cable TV and off-air antenna signals

Take Note: Both the *Bridged Telephone Module* and the *Category 5 Voice* and Data Module are available as stand-alone units and can be used for expansion or special applications, when properly mounted and installed.

Installer's Tip: Leviton's *Pre-Configured Structured Cabling Panels* combine the most popular distribution modules into single units that will suit the needs of many of your customers. These panels can always be replaced or supplemented with individual modules if a customer's needs change in the future.

Each metal SMC comes with pre-drilled holes spaced to accept the snap-in plastic connectors mounted on Leviton's modules and *Pre-Configured Structured Cabling Panels.*

6.1.1 Series 280 SMC



The *Series 280* is designed for expanded installations. Using the SMC 280 in an Essential infrastructure installation ensures "room to grow". Remember, the main difference among the different SMC's is the size of the enclosure and AC power options. The Series 280's twenty-eight inch length gives it abundant room for up to eight individual distribution modules (sizes and density of the modules will vary). This means you can use a single distribution center for all the latest technology such as home networking, security cameras, and multi-location stereo. The panel features multiple knock-outs throughout for ease of cable routing. The *Series 280* is designed to accommodate Leviton's hospital-grade *AC Power Module* with power surge suppression for all internal electronic modules connected to it.

Installer's Tip: In addition to its *AC Power Module*, Leviton also offers a *DC Power Supply Module* that supplies DC power to multiple modules within an SMC. Each DC component is wired to the module's outputs and the module itself plugs into a standard 120VAC outlet. This eliminates the need for multiple, individual power supplies within the SMC.

Details

- Large capacity can service more intricately wired homes
- Accommodates 1/4, 1/2, and full-width expansion modules and both horizontal and vertical placement for most modules
- The SMC is constructed with white, powder-coated 18-gauge steel whose cover features a 3/4" overlap to hide irregular drywall openings

Dimensions

- Enclosure: 28"h X 14.38w X 3.60"d
- Cover: 30"h X 16.0" w

For a three-bedroom, single-family home with an SMC 280, Leviton suggests the following components to meet most homeowners' structured cable needs:

- Coax surge protector
- *AC Power Module*
- Basic Home Networking Unit consisting of a 1X9 *Bridged Telephone Module*, a single *Cat-5 Voice/Data Module*, and a 1X6 *Video Splitter* with terminators

This system will handle a maximum of nine telephone locations, six locations for data networking, and six video locations. You can expand the system to more telephone, data networking, and video locations by adding more modules.

6.2 Essential Infrastructure Platform for a Multiple Dwelling Unit

Along with single-family homes, structured cabling is regularly installed in new apartments and condominiums as well as retrofitted into remodeled older buildings. With less square footage and typically fewer inhabitants than a single-family home, a normal-sized MDU (multi dwelling unit) won't require a large SMC for its *Essential Infrastructure* platform. Leviton's 100 and 140 series SMCs will more than handle jobs this size.

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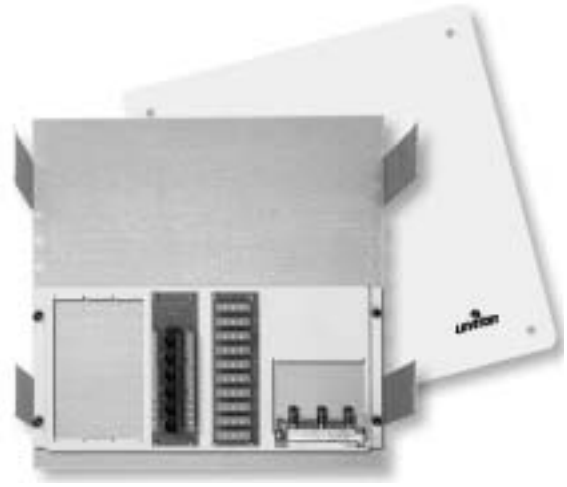

Series 100 SMC with basic home networking module

6.2.1 Series 100 SMC

The *Series 100* is Leviton's most economical unit, yet it can accommodate distribution modules and pre-configured panels for basic voice, data, and video needs. It is an ideal panel for the essential configurations often used in condominiums and apartments. Its two-stage, construction-ring-style installation (a construction ring is mounted first, prior to drywall, and an insert and cover added during trim-out) avoids potential damage during the rough-in phase of construction.

Details

- Construction Rings are sold five to a box
- Inserts and covers are sold as part of a kit that includes your choice of one of four Pre-Configured Structured Cabling Systems
- All materials are UL listed
- The insert cover comes in white powder-coated 18-gauge steel and the insert is 18-gauge galvanized steel

Dimensions

- Construction Ring: 17.60" h X 17.60" w X 3.39" d
- Insert: 13.36"w X 6.25"h X 2.50"d
- Cover: 16.10"h X 16.10"W

6.2.2 Series 140 SMC

The *Series 140* is a professional-grade whole-house media enclosure that is well suited for a MDU or even a typically sized detached home. It can accommodate two *Pre-Configured Structured Cabling Panels* or an assortment of both full and half-width expansion modules. Two or more Series 140 SMC's can be combined for larger installations.

Installer's Tip: Think of a SMC the same way you would a service entrance. A 200-amp panel allows for plenty of future expansion of an electrical service whereas a 150-amp panel that meets a customer's immediate needs might not. Although additional Series 140 subsystems can be added as demand for structured wiring increases, you might be better off installing the larger Series 280 or 420 at the outset.

Details

- Enclosures with covers are sold separately or as a kit that includes your choice of *Pre-Configured Structured Cabling Panel*
- The enclosure works for both new construction and retrofits because it can be either surface-mounted or recessed between wall studs
- The SMC is constructed with white, powder-coated 18-gauge steel whose cover features a 3/4" overlap to hide irregular drywall openings

Dimensions

- Enclosure: 14.38"h X 14.38"w X 3.60"d
- Cover: 16.10"h X 16.10"w

The following components, installed in a SMC 140, will comfortably serve a three-bedroom condominium, apartment, or townhouse:

- *1X9 Bridged Telephone Module*
- *Cat-5 Voice and Data Module*
- *1X6 Video Splitter Module*
- *J-Box Kit* (provides surge protected AC power)
- Coax surge protector

This platform will accommodate a maximum of nine telephone locations, six data networking locations, and six locations for video.

Series 140 SMC with a video amplifier

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6.3 Enhanced Infrastructure Platform

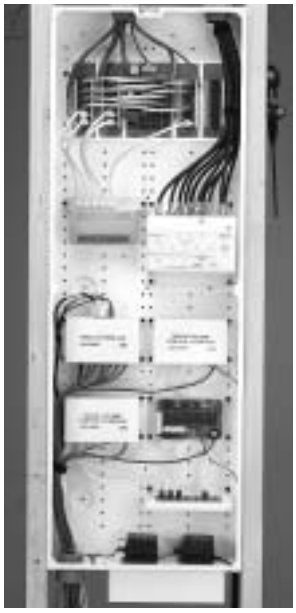
Larger homes or customers with greater structured cabling needs require larger SMC capacity. Contractors can either:

- Install more than one SMC to accommodate the required distribution modules
- Install a *Series 420 SMC*

Take Note: Leviton SMCs can be readily combined to provide all the distribution needed for structured cabling projects. There are no design limitations to the potential size of a job.

6.3.1 Series 420 SMC

The *Series 420* is Leviton's largest SMC measuring forty-two inches high. It can accommodate several panels and modules, allowing it to manage many high tech functions simultaneously. Its dimensions and details are similar to the *280 Series* except for its greater length.



Series 420 SMC

The 280 and 420 *Structured Media Center* can accommodate a varying array of individual distribution modules from *Leviton's Integrated Networks™ Structured Media* line including:

- *3X8 Bi-Directional Video Module, P/N 47690-38B*
- *1X6 Passive Audio Module, P/N 48211-6A*
- *Video Amplifier, P/N 48210-VA*
- *1X4, 1X6, and 1X8 Video Splitters, P/N's (1 GHz) 47690-4C, 47690-6C, and 47690-8C: P/N's (2 GHz) 47690-4C2, 47690-6C2, 47690-8C2*
- *10Base-T (w/power adapter)(P/N 47605-EH) or 10/100Base-T Network Hub (w/power adapter)(P/N 47605-ETX)*
- *Video Sequencer and Modulator (P/N 48213-CVS)*

An enhanced infrastructure for a four-bedroom home would include the following components in a SMC 420:

- *Coax surge protector (P/N 47690-6S)*
- *AC Power Module (P/N 47605-DP)*
- *Advanced Small Office Unit consisting of two Category 5 Voice & Data Modules, a Telephone Distribution Module, a 1X6 Video Splitter*, and *7" Patch Cords*

This infrastructure will accommodate a maximum of twelve telephone locations or twelve data locations, and six video locations. You can expand the system to more telephone, data networking, and video locations by adding more modules.

6.3.2 Media Versatile Panel

The *Media Versatile™ Panel,* which is based on the professional-grade enclosures typical of commercial installations, comes with a 3/4" plywood open architecture backing that allows you to attach your modules with wood screws in any pattern you choose. This versatile panel is perfect for remodeling jobs where you might find existing components of varying sizes that a customer wishes to reuse while also adding new Leviton modules.

Details

- Openings for both cable bundles and 1" and 1.5" conduit fittings
- Securable door
- Wall or surface-mounted
- Powder-coated, 18 gauge steel construction

Dimensions

- 24"h X 14"w X6"d

While the *Pre-Configured Structured Cable Panels* work very well for basic installations, your installation might call for a more customized infrastructure.

Media Versatile™ Panel

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6.3.3 Wallplates, Jacks, and Connections

The variety of terminating connectors, jacks, and wallplates, the small, but critical components of any system infrastructure, will be discussed in section 8.

You have a choice of 1, 2, 3, 4, or even 6 position QuickPort or Decora style wallplates along with Category 5 or 5e jack, F-Connector, audio binding post, and blank snap-in inserts. You can order the wallplates and snap-in inserts in white, almond, or ivory colors.

Installer's Tip: For both basic and enhanced infrastructure, Leviton recommends a minimum of Category 5 or 5e twisted-pair cable for telephone and data, RG-6 quad shield coaxial cable for video cable, CATV, TV, DSS, and monitoring, and 16/2 or better class 2 stranded copper for speakers.

6.4 Distributed Video (CATV, DSS, other Services)

You have several options for distributing video service to more than one location:

1. Install a *video splitter* with or without a separate video amplifier (depending on signal level available)
2. Install a module that includes an amplifier (3X8 Bi-Directional Video Module)

6.4.1 Passive Video Splitters

Leviton's *video splitters* (1X4, 1X6, and 1X8) are basic passive video distribution units. Depending on your specific job, one of these splitters on its own may not be sufficient to serve all of its intended devices with picture-clear reception. Several factors will affect reception, including:

- The number of devices being served by the incoming coax cable (the rule of thumb is that the more cable locations, or drops, the greater the losses).
- The type and quality of the cable
- The quality of the local cable signal
- The quality and workmanship of the connectorization of the cable
- The overall length of the cable runs (locations at the far end of the home may suffer from line losses).

Please see the Splitter Signal Loss Chart in Table 6.4. You should be aware that the CATV signal level delivered to the house will be between 0dBmV and 15dBmV. You can calculate the signal level based on a loss budget calculation as follows:

Frequency	*Channel Range*	*Insertion Loss (dB)*		
		1 X 4	*1 X 6*	*1 X 8*
50 MHz	*2 through*	*-6.6*	*-8.9*	*-10.0*
1000 MHz	*140*	*-7.3*	*-10.0*	*-11.0*
950 MHz	*Digital Cable*	*-7.7*	*-11.0*	*-11.9*
2000 MHz	*Channels*	*-10.5*	*-14.0*	*-15.7*

Total Cable Loss = (Loss in dB/100 Ft @ Highest Frequency to be Transported) X (Cable Length) X (.01)

Total System Loss = Total Cable Loss (above calculation) + Splitter Loss (from table 6.4)

It may be necessary to install a separate *Video Amplifier* to strengthen the video signal. This amplifier features:

- A variable attenuator for accurate level setting and the clearest signal possible
- A boosting of signal strength up to 25 dB
- FM Trap (FM signals not amplified)

Installer's Tip: Be sure to thoroughly discuss video and TV options with your customer. You do not want to be explaining poor or unacceptable picture quality at the end of an installation because of a poor wiring or component choice.

6.4.2 Satellite Signal Distribution

The *3X4 Multi-Switch* uses multiple inputs to distribute satellite and TV antenna signals throuhout the home. By combining signals from dual incoming LNB (low noise block) digital satellite systems, and with transmission from an off-air antenna on a single coaxial cable, it can distribute signals to up to four TV's. The Multi-Switch incorporates a separate input to receive TV antenna signals which is best used in combination with a video amplifier.

6.4.3 Modules with Built-in Amplifiers

The *3X8 Bi-Directional Video Module* supports bi-directional signaling.

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- Sends video to up to eight televisions within the home
- Amplifies incoming signals
- Provides two auxilliary inputs and combines them with the internal 8-way splitter; Requires a modulated signal with 20-30 dB signal strength such as Leviton's SMC Modulator (P/N 48213-VMA)
- Distributes CATV or terrestrial antenna signals out to eight locations with no loss
- Includes two DSS antenna inputs passed through to two outputs to DSS receivers

6.5 Multi-Room Audio/Video Options

Leviton's *Decora Media System* (DMS) utilizes advanced electronics and Category 5 or 5e cable to distribute audio and video signals throughout a house. Signals from a VCR, DVD, cable TV, A/V Center, or even a PC/MP3 Player, satellite, and security cameras can be sent through up to 1000 feet of Category 5 or 5e cable with no discernable distortion. The DMS is composed of three components:

- A *send* unit for transmitting signals at the source
- A *receive* unit for receiving signals
- A *Media Hub* for whole house distribution to up to six receive units

Decora Media Hub

Several topologies are possible within the DMS including:

- An audio/video networking scheme, with A/V or PC components sending and receiving audio/video signals via a single send and multiple receive units and the centralized hub
- A hub-to-receive model where information is sent to and from the hub to remote receive units
- A point-to-point model where the send and receive units are linked directly together

The DMS has the following features:

- "Daisy chain" feature for hubs: distribute audio/video signals to over 20 locations
- Composite (baseband) RCA inputs (L/R Audio and Video) for connectivity directly from a single audio/video source
- Send and receive units fit standard single-gang electrical boxes and LV rings
- Advanced circuitry with automatic equalization streams analog audio and video signals with less distortion
- Stereo audio input/output handles Dolby® ProLogic™ surround signals

All the components in the DMS are powered with 15 Vdc and can be powered either independently or through the Media Hub. *Important: This product requires a dedicated Category 5 or 5e run.*

Note: *The DMS Hub requires the 15 VDC Power Supply (Supplied)*

6.5.1 Stereo Modulator

The *Stereo Modulator* is a desktop-style device designed to work with audio/video components such as DVD players. It takes the signal from an audio/video

Stereo Modulator

component and converts the signal to a cable TV channel that can be broadcast over the whole-house coaxial network to multiple televisions on one unused cable channel, effectively setting-up an in-home entertainment channel. The "frequency agile" modulator outputs on any UHF channel between 14 and 69 or CATV channel between 54 and 94 and 100-125 (channels 75-80 are recommended with the *Notch Filter, P/N 47689-B)*.

6.5.2 DC Power Distribution Module

The *DC Power Distribution Module* is a unique solution for supplying high-quality electrical power to the separate DC-powered components in the *Structured Media Center* (SMC). This module reduces clutter and opens up space in the SMC by eliminating the need for multiple DC power supplies. Powered by a single 1.5 Ampere DC power supply, the *DC Power Distribution Module* provides fully-regulated 12 Vdc power for up to 12 individual devices.

Power Distribution Module

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The *DC Power Distribution Module* features:

- 12 outputs that provide 12 Vdc power for up to 12 devices
- F-connector output for the 3 X 8 Bi-Directional Video Module
- 1500 mA maximum
- Six removable double screw terminal jacks with slot drive screws
- Shipped with (6) 18 gauge pigtails with 2.5 mm power jacks

Module	*Power Consumption (mA)*
3 X 8 Bi-Directional Video Module	*80*
Decora Media System	*60*
Decora Camera	*70*
Outdoor Camera	*225*
Video Amplifier	*500*
Video Sequencer	*100*
IR Emitter	*500*
Digital Volume Control	*75*
10/100Base-T Hub	*1200*

Module Power Consumption Table 6.5

- Fully regulated (12 volt DC regulated output)
- 1 Input - utilizing plug-in DC transformer power supply
- Dimensions: 6.58" X 2.5" X 1.5"

Use the chart on Table 6.5 (below) showing the power consumption of various modules to ensure that you will not exceed the current for one Power Distribution Module. Just add up the current for each module you are using. If the total current exceeds 1450 mA, use a second *DC Power Distribution Module* with its DC Power Supply.

6.5.3 Multi-Room Infrared (IR) Repeater

Infrared technology allows for the remote control of audio/video devices when the user and the device are in different rooms. Leviton's *IR Extender* consists of three components:

1. *IR Target (P/N 47621-MIE)*
2. *IR Emitter (P/N 47621-CMS)*
3. *110 Distribution Block (P/N 47603-110 or 47689-B)*

The *IR Repeater* system is simple: the IR target takes the signal from a remote control for an audio/video component, such as a DVD player, and converts it to a low-voltage electrical signal. This signal is converted back at the component to be controlled by the *IR emitter*. The IR target is installed in a ceiling or wall and connects to the *IR emitter* with Cat 5 cable. Each component has its own emitter. An IR distribution block installed inside the Structured Media Center routes each signal to the appropriate component.

The *IR Repeater* has the following features:

- Low-profile, flush-mount design of the target
- Two signal connections and two power connections
- Easy-to-install, adhesive backing on emitter
- DC power supply required

Installer's Tip: Be sure to discuss the location of the various IR targets with your client before wiring them. Some might object to a ceiling installation and other will want to designate a specific location.

The *IR Emitter* plugs into a dedicated Category 5 or 5e jack at the equipment location. The *Repeater* requires a dedicated Category 5 or 5e cable from the target to the SMC and to the Category 5 or 5e jacks.

6.6 Multi-Location Networking

With the advent of multiple PC households and home offices, home networking will be more in demand by your customers and clients. Category 5 or 5e cable allows both high speed and high capacity data transfer. A Category 5 or 5e module and hub provides a central point from which to service multiple PC's and peripherals.

Depending on the number of devices and PCs that require network access, you can choose additional Category 5 or 5e modules combined with a network hub to connect the termination points. Leviton offers two such hubs:

- The 10Base-T Network Hub
- The 10/100Base-T Network Hub

The combination of structured cabling and a network hub creates an in-home Ethernet data network when used with network cards or adapter-equipped PC's and associated software.

6.6.1 10Base-T Network Hub

The professional-grade *10Base-T Network Hub* offers:

- Category 5 or 5e patch cord connection to the *Category 5 Voice and Data Module*

10Base-T Network Hub

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- Data collision and jabber handling functions
- 10 Mps performance speed
- Five Category 5 or 5e RJ-45 ports, including one port for expansion
- IEEE 802.3 compliant
- LED lights to indicatePower, Link/Receive, Partition Power, and Collision status
- Up to fourteen network connections by uplinking a maximum or four hubs with a NORMAL/UPLINK switch
- Auto partitioning and reconnecting of ports to facilitate faulty segment isolation

The 10Base-T Network Hub is packaged with a Power Adapter. Please note that the power required is 7.5 Vdc. This hub is an excellent choice for most residential needs such as sharing printers and other peripherals as well as networking PCs for file sharing and multiplayer games.

6.6.2. 10/100Base-T Network Hub

10/100Base-T Network Hub

This hub shares the same properties as the 10-Base-T Network Hub, but with its faster speed of 100Mbps, the 10/100Base-T Network Hub can meet the more demanding needs of a home office and telecommuting applications. Some of these applications include sharing high-speed and capacity devices such as zip drive and back-up systems. The hub will automatically adapt to either a 10Base-T or 100BaseT attached device. Note that a 10/100Base-T hub will operate only as fast as the slowest device attached.

6.7 Multi-Room Stereo Sound Application

New homes are becoming increasingly pre-wired for audio. Once again, a single, central distribution point is the best solution for most installations. The *Leviton Multi-Room Stereo Sound application* can accommodate up to six pairs of speakers when wired correctly. The *impedance matching analog volume control* adjusts the volume of individual zones in the home. Two sets of eight-inch in-wall speakers and two analog volume controls are included in the system package. One indoor and one outdoor wallplate configured with binding posts for customer stereo speaker terminations are also included.

This application features:

- Easy hookup to the audio distribution module in the SMC for multiple speakers
- Volume controls fit in single-gang box or mud ring

1 X 6 Passive Audio Module

6.7.1 Audio Controls

Leviton offers three series of audio controls in its Composer Series. Each is appropriate for a specific power installation range.

The ***Brahms Stereo Volume Control*** is a 75 watt (25 watts of RMS) control that is ideal for low to moderate power installations including those with dedicated multi-room amplifiers and mini-systems. The ***Brahms*** series can accommodate 4, 8, or 16 Ohm speakers and amplifiers up to 75 watts. This series features:

- Attenuation: -34 dB in 12 steps
- Attenuator type: tapped auto transfer
- Power rating: UL Listed @75 watts audio, 25 watts RMS continuous
- Screw type connections and a 12-position rotary switch
- Rotary controls built tapped auto-transformer design

Brahms offers individual controls whose range of features include dual volume capability, a headphone jack, and even an outdoor model.

Leviton's ***Strauss' Volume Controls*** have similar features to the *Brahms* controls, but come with a higher power rating of 216 watts. This makes them ideal for home theatre receivers and built-in impedance matching separate power amplifiers. With their higher current capabilities, the Strauss series is built to resist saturation and degradation even after years of high-volume use all the while maintaining signal purity.

The ***Decora Digital Chopin Volume Control*** interface replaces traditional transformers and rotary controls with an advanced interface module and one-touch

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rocker switch. The volume control unit mounts inside a standard wall box or low-voltage mud ring and connects to the *Interface Module* inside the *Structured Media Center* with Category 5 or 5e cable.

The ***Chopin Volume Control*** features:

- A single RJ-45 connection to an Interface Module instead of direct speaker/amplifier connections required at the controller
- Two RJ-45 jacks on each digital volume control so that the volume controls can be interconnected and operate like a three-way light switch at two locations in a long hallway, large room, or patio
- Start-up mute feature to avoid shocking people with excessive audio levels when control is activated
- Microprocessor-controlled relays in the Interface Module for silent switching
- Digital, transformer-free design uses aerospace-quality cermatile resistors for proper heat dissipation and superior performance
- Up to three volume controls can be connected to the interface module for controlling any one zone

6.7.2 Multi-Room InfraRed (IR) Repeater

In addition to the traditional audio controls listed above, Leviton's Multi-Room InfraRed IR Repeater (see 6.5.3) allows the user to control an audio device from a remote location.

6.7.3 Speakers

Leviton offers speakers that meet any number of installation requirements including:

- In-wall installations (music and home theater)
- Ceiling mount
- Surface mount
- Outdoor applications

All Leviton in-wall and ceiling series speakers incorporate the following features:

- Long-throw, high-output woofers
- Ultralight polydome tweeters
- Low-loss precision crossover network for smooth, linear response
- Paintable grills and frames that can be made to match any décor
- Mounting frames for easy installation
- Acoustically engineered for optimum performance when installed in walls or soffits
- Nominally rated at 8 Ohms impedance and 90dB sensitivity
- 60 and 100 watt ratings depending on the speaker model

Take Note: Leviton's outdoor speakers include 100 watt and a 60 watt models built to resemble natural rocks and thus blend in with the surrounding environment. These speakers, which come with Direct Bury 16/2 speaker wire, are built to withstand environmental extremes including heat and humidity. A weatherproof Multi-Purpose Surface Mount speaker is also available.

6.8 Home Video Security Monitoring with Indoor and Outdoor Camera Application

Note: *This application requires dedicated pre-wiring*.

Once seen only in commercial settings, security cameras are finding their way into private homes as well. Leviton's indoor Decora® Camera provides high-quality color video output, and the outdoor camera allows outside monitoring. The camera's output connection allows you to use RG-6 quad shield for the video signal and Category 5 or 5e for power.

The Decora® Camera and outdoor camera can be used in two ways:

1. They can be plugged directly into an auxiliary video input on a television or VCR (usually marked "Video 1 or Video 2")
2. They can be used with a distribution component such as a modulator or video sequencer (explained in Chapter 9)

Installer's Tip: The cameras should be located within one hundred cable feet of the SMC.

The Decora® Camera features:

- Color CMOS imaging
- Connection for power and ground
- RCA jack and RCA-to F-connector adapter for connecting video to coaxial cable
- Adjustable horizontal pan for full room coverage
- LED power indicator

Decora® Camera

Outdoor Camera

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The outdoor camera has the same features except it also includes an audio signal (carried over the Category 5 or 5e cable) and a pan adjustment (the whole case is adjustable).

6.8.1. Video Sequencer

Leviton's Video Sequencer allows the user to monitor up to four Decora Cameras (both indoor and outdoor) simultaneously in any combination.

Video Sequencer

The Video Sequencer:

- Provides images from each camera by automatically switching among them
- Allows for 1-30 second variable time setting between cameras
- Has a manual step feature that allows for individual camera monitoring
- Has four composite RCA audio/video inputs and a set of two RCA outputs for interfacing to a monitor and modulator, or up to two modulators (e.g., one going to a VCR)

The *Video Sequencer* requires a 12 Vdc power supply or the DC Distribution Module.

6.8.2. Media Center Modulator

Another component in Leviton's home security monitoring group is the *Media Center Modulator*, which in conjunction with the *Video Sequencer*, converts the composite signal from a *Decora Camera* to a selected TV channel through the use of a programmable, pushbutton interface. As previously noted, this signal can be broadcast over the whole-house coaxial network to multiple television sets using a dedicated channel. When used in conjunction with CATV, a notch filter will be needed for the channel range that includes the modulated channel, e.g., 75-80 range for Channel 78.

The *Media Center Modulator* features:

- RCA video and stereo audio inputs (loop through feature only)
- F-connector output (channels 14-94 UHF and 100-125 CATV)
- Mono audio broadcast

This component requires a 12 Vdc power supply or the DC Distribution Module.

6.8.3. RF Notch Filter

Although the *Media Center Modulator* allows output on CATV channels 14-94 and 100-125, Leviton recommends using a channel range well beyond that served by your local CATV provider. If a clear series of channels is not available, use a channel in the range 75-80 and add the Notch Filter. This filter is used whenever the modulator is used with other *Structured Media Video Distribution Modules* (such as the 3X8 Bi-Directional Video Module). It is unlikely that you would not be using one of these modules with the modulator so an *RF Notch Filter* should be figured into your estimate and materials list.

6.9 What You Need to Know

- Structured Media Centers (SMCs) are the single distribution points for low-voltage wiring systems. They vary in size, allowing for simple to more complex installations.
- Pre-Configured Cabling Panels offer the most requested distribution modules and act as simplified, basic system building blocks.
- You can infinitely customize your system using individual distribution modules.
- Clear audio/video transmission requires more vigilant selection of components given that these are more subjective media for most people. Your cable and hardware selections must match up with the system requirements and your customer's expectations.
- Home monitoring camera installation will be based in part by the location of your SMC.

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SYSTEM DESIGN

7 System Design and Placement—Laying Out the Basics

In years past, low-voltage cable and wiring meant telephone lines, intercom systems, and door chimes. Structured wiring today means ethernet connections, multiple phone and dedicated data lines, multi-location stereo, and more. It's increasingly important to carefully design your system and write up a plan for cable, device, and distribution center placement. With the median size of newly constructed homes in the U.S. rising to at 2,000 square feet in 1998 (suggesting both more and larger individual rooms) and with condominiums and apartments becoming increasingly "tech wired", your plans will include plenty of structured cable. This section will deal with the basics of your low-voltage wiring plan.

7.1 Laying Out the Basics on the Floor Plan

A well-prepared floor plan done in advance of your installation will save you headaches later. It isn't enough to simply call for installing one phone jack or cable TV termination per room. Your plan, or a designer's plan, must be thoroughly discussed with your client. This plan should include:

- The specific locations for each type of device (phone, audio-video, computer data, etc.)
- The types of cable that will be run to these locations and cable routing
- Allowance for future expansion as your customer's needs change
- Allowance for changes as the role of various rooms change (a bedroom becoming a home office, for example)
- When a DSL modem is anticipated, allow for three (3) category 5 or 5e jacks in a location, and when a Cable modem is anticipated, allow for three (3) coax and two (2) category 5 or 5e jacks in a location.

If your client is unsure of a specific wall location for a device, then suggest that two or more be installed to cover all possible choices. You can't predict furniture placement and you're better off running more cable, if a budget permits, than coming back later to add to the run. The minimum grade cable you should run is Category 5. Mark all your proposed locations with blue masking tape or similar material and do a walk through with the homeowner prior to installation. When your client is satisfied with your plan, you can decide the best system installation to the plan requirements.

Be sure to plan "beyond the basics." The Category 5 or 5e UTP and RG-6 coaxial cabling of the Essential and Enhanced infrastructures will cover three applications: telephone, data, and coaxial video (CATV) distribution. Additional applications such as multi-room video, multi-location stereo, and home monitoring all require additional dedicated wiring.

Remember that low-voltage structured cable requires gentler handling during installation. When developing your floor plan, be sure that you have sufficient access to pull the cable without damaging it.

Installer's Tip: Your Leviton Technical Support representative can always assist you with any installation problems that occur outside of the scope of this manual. Call the Leviton Technical Support line at (800)-722-2082.

7.2 System Choices and Options

Leviton Integrated Networks Structured Media subsystem offers a complete convenient array of distribution panels and devices to manage your client's telephone, data, and multi-room audio/video requirements. Options range from basic phone, internet, and cable TV to more advanced applications such as home theatre and home offices. These subsystems, as described in chapter 6, always start with include the one of the following Structured Media Centers:

- Series 100
- Series 140
- Series 280
- Series 420

These subsystems also include the Media Versatile Panel.

continued on page 7-8

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ENHANCED STRUCTURED MEDIA PLATFORM - 1ST FLOOR (TYPICAL)

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ENHANCED STRUCTURED MEDIA PLATFORM - 2ND FLOOR (TYPICAL)

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Connection Planner

		QuickPort connectors									QuickPort platform			
		Voice	Data	F-conn/ coax	Speaker terminals	Speaker terminals	RCA	RCA	RCA		Decora wallplates	QuickPort inserts	Flush-mount wallplates	Blanks
	Leviton part numbers	40830-B* Category 5	40830-B* Category 5	40830-B* gold coaxial	40830-B*E (black stripe)	40830-B*R (red stripe)	40830-B*E (black stripe) audio left	40830-B*R (red stripe) audio right	40830-B*Y (yellow stripe) video		80401-* nylon single	40754-B* four port	40804-B* four port	40859-B*
	Total Req'd.	10	6	16	6	6	2	2	1	0	0	0	19	26
Room type & applications	Number of locations planned													
1. Living Room														
telephone														
data (multi-location networking)														
cable TV														
satellite TV														
home theater														
multi-location stereo														
2. Kitchen														
telephone														
data (multi-location networking)														
cable TV														
satellite TV														
home theater														
multi-location stereo														
3. Family room														
telephone														
data (multi-location networking)														
cable TV														
satellite TV														
home theate														
multi-location stereo														
home monitoring														
4. Dining room														
telephone														
data (multi-location networking)														
multi-location stereo														
5. Home office														
telephone														
data (multi-location networking)														
cable TV														
satellite TV														
multi-location stereo														
6. Master bedroom														
telephone														
data (multi-location networking)														
cable TV														
satellite TV														
multi-location stereo														

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	Other location-based components														
		8-inch Speakers	8-inch Speaker		6.5-inch Speakers	Outdoor Speaker	Weather Cover	Analog Vol. Control	Digital Vol. Control	Decora Media Sys.	DMS Send Unit	DMS Rec. Unit	Other Components	Decora Camera	Outdoor Camera
	Leviton part numbers	40890-WP pair	40890-WS single		40891-W pair	40827 single	5977-GY	40841-D* Impedance Matching	48211-V* Impedance Matching	48210-MCH	48210-MSU	48210-MRU		48213-*DC	48213-*OC
		Total Req'd.	6		1	1	2	1	4	4	1	1		1	1
Room type & applications	Number of locations planned														
1. Living Room															
telephone															
data (multi-location networking)															
cable TV															
satellite TV															
home theater															
multi-location stereo															
2. Kitchen															
telephone															
data (multi-location) networking)															
cable TV															
satellite TV															
home theater															
multi-location stereo															
3. Family room															
telephone															
data (multi-location) networking)															
cable TV															
satellite TV															
home theater															
multi-location stereo															
home monitoring															
4. Dining room															
telephone															
data (multi-location networking)															
multi-location stereo															
5. Home office															
telephone															
data (multi-location) networking)															
cable TV															
satellite TV															
multi-location stereo															
6. Master bedroom															
telephone															
data (multi-location networking)															
cable TV															
satellite TV															
multi-location stereo															

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Connection Planner (continued)

			QuickPort connectors									QuickPort platform	
			Voice	Data	F-conn/ coax	Speaker terminals	Speaker terminals	RCA	RCA	RCA		Decora wallplates	QuickPort inserts
	Leviton part numbers		40830-B* Category 5	40830-B* Category 5	40830-B* gold coaxial	40830-B*E (black stripe)	40830-B*R (red stripe)	40830-B*E (black stripe) audio left	40830-B*R (red stripe) audio right	40830-B*Y (yellow stripe) video		80401-* nylon single	40754-B* four port
	Total Req'd.		10	6	16	6	6	2	2	1	0	0	0
Room type & applications	Number of locations planned												
7. Bedroom 2/ nursery													
telephone													
data (multi-location networking)													
cable TV													
satellite TV													
multi-location stereo													
home monitoring													
8. Bedroom 3													
telephone													
data (multi-location networking)													
cable TV													
satellite TV													
multi-location stereo													
9. Bedroom 4													
telephone													
data (multi-location networking)													
cable TV													
satellite TV													
multi-location stereo													
10. Laundry													
multi-location stereo													
11. Garage/ workroom													
telephone													
multi-location stereo													
12. Exterior (front and back yards)													
multi-room stereo													
home monitoring													

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	QuickPort platform				Other location-based components											
		Flush-mount Wallplates	Blanks		8-inch Speakers	8-inch Speaker	6.5-inch Speakers	Outdoor Speaker	Weather Cover	Analog Vol. Control	Digital Vol. Control	Decora Media Sys	IR Ex-tender	Decora Camera	Outdoor Camera
	Leviton part numbers	40804-B* four port	40859-B*		40890-WP pair	40890-WS single	40891-W pair	40827 single	5977-GY	40841-D* Impedance Matching	48211-V* Impedance Matching	Other Equipment	47621-MIE and 47621-CMS	48213-*DC	48213-*OC
	Total Req'd.	19	26	0	6	1	1	2	1	4	4		3	1	1
Room type & applications	Number of locations planned														
7. Bedroom 2/ nursery															
telephone															
data (multi-location networking)															
cable TV															
satellite TV															
home theater															
multi-location stereo															
8. Bedroom 3															
telephone															
data (multi-location) networking)															
cable TV															
satellite TV															
home theater															
multi-location stereo															
9. Bedroom 4															
telephone															
data (multi-location) networking)															
cable TV															
satellite TV															
multi-location stereo															
10. Laundry															
multi-location stereo															
11. Garage/ workroom															
telephone															
multi-location stereo															
12. Exterior (front and back yards)															
multi-room stereo															
home monitoring															

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continued from page 7-1

The primary difference among the SMCs is their size: the larger the box, the more modules and panels it can hold. In addition, (the 280 and 420 series each have a surge-protected AC power option to accommodate multiple active modules). There is virtually no limit to the size or complexity of the system you install in a normal residence. Every room can be wired for data, telephone, and multi-media. Unlike AC wiring, where you must meet, for instance, mandatory spacing requirements for devices and minimum installation standards, residential structured cable standards are more versatile.

Take Note: The key to structured wiring is to have a single distribution center as the point of origin for your cables rather than a series of stand alone modules. Make sure all modules are installed in a Structured Media Center.

Installer's Tip: You can always install additional SMCs should your client's needs exceed the capacity of a single unit.

7.3 Mud Ring Locations

Leviton strongly advocates the use of mud rings for wiring wall plate locations if allowed by local codes. Mud rings make it easier for you to maintain a service loop, or extra cable, in the wall cavity without the possible damage or excessive bending to a cable that can result from stuffing it into an electrical box. Their locations by room and within each will be determined by your floor plan and by the end use device.

Installer's Tip: You can use a standard electrical box if you haven't got a mud ring, but remove the back section from it first. This will allow you to leave a service loop in the wall while providing a mounting surface for your device and cover plate.

7.3.1 Location Matrix by Type

Location will depend on the floor plan, but you can assume the following:

- Install a mud ring for one phone and one data port per room
- Allow for one audio/video device per room
- Allow for one analog volume control wall unit per stereo speaker zone requiring a volume control.
- Every room with a security camera will require one mud ring at the camera location

Installer's Tip: Just as the NEC prohibits the installation of AC electrical outlets above most baseboard heaters (Section 110-3[b]) because of the potential damage to any electrical cord plugged into that outlet, you will want to avoid installing a low-voltage device above these heaters for the same reason.

7.3.2. Number per Room

The TIA/EIA Residential Telecommunications Cabling Standard suggests the following in regard to telecommunications cabling:

- A minimum of one outlet location (where applicable) in the kitchen, each bedroom, the family or great room, and the den or study
- Sufficient outlets in each of these rooms along any unbroken wall spaces measuring twelve feet or more in length
- Additional outlets as needed so that "no point along the floor line in any wall space is more than twenty-five feet, measured horizontally, from an outlet location in that same space"

7.3.3 Installation Height Above the Floor

It's difficult to state any hard and fast rules regarding the location of most mud rings. In a children's playroom, for instance, your client might want a wall phone installed lower than the 48" standard height. The height of a counter or backsplash, or the location of a sink for that matter, will determine the placement of mud rings in a kitchen. Using AC wiring as a guideline, you're safe installing your mud rings at the following heights measuring from the floor to the bottom of the mud ring opening:

- Wall phones: 48"
- Desk phones and fax, data ports, audio/video, and floor-mounted speakers: 15" or the same height as to the bottom of installed electrical outlet boxes"
- Wall-mounted speakers: vary by design and plan
- Volume control for speakers: same as to the bottom of electric light switch boxes
- Wall-mounted security camera: varies by design and plan

Installer's Tip: As you'll see in Section 8, be sure to run your low-voltage wiring in a separate stud space from the AC cable. Be sure your mud ring locations keep this rule in mind.

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7.4 Cabling Types and Counts for Each Location

AC wiring varies by gauge size. The end use device or appliance dictates the ampacity amperage of the circuit and thus your choice of cable (14/2, 12/2, etc.). Low-voltage wiring varies by type and to a lesser extent by gauge (most will normally be 24 AWG).

The TIA/EIA Standard 570-A proposes different grades of residential cabling depending on the services the cable will be providing within a residence. There are two grades:

- Grade 1
- Grade 2

Grade 1 meets the minimum requirements for telecommunication services. It can support telephone, CATV, and low speed data applications. These minimum requirements are a four-pair 100 ohm UTP that meet or exceed Category 3 transmission requirements and 75 ohm coaxial cables.

Grade 2 meets all of Grade 1 requirements as well as multimedia applications and fiber optic wiring. The minimum cable requirements for each cabled location are two four-pair 100 ohm UTP cables that meet or exceed Category 5 or 5e cable and two 75 ohm coaxial cables. Two strand 62.5/125 mm optical cable is an optional cable for Grade 2 installations.

When a DSL modem is anticipated, allow for three (3) category 5 or 5e jacks in a location, and when a Cable modem is anticipated, allow for three (3) coax and two (2) category 5 or 5e jacks in a location.

Installer's Tip: Leviton strongly suggests that you use nothing less than Grade 2 infrastructure, Category 5 (at a minimum) or 5e cable for your structured voice/data cable work, and RG-6 quad shield cable for video work.

Installer's Tip: make sure all wire and cables meet all local safety and fire codes, and make sure that they are rated for in-wall use. Approved wire and cabling will feature a classification (such as CL-2, or Class 2) to indicate suitability for installation. Failure to follow this procedure could result in exposure to insurance and even legal problems.

Each end use application will determine your choice of cable.

7.4.1 Telephone and Data Cable: Category 5 or 5e UTP

Always use Category 5 or 5e cable for these applications. When properly installed, it It can carry up to 100 Megahertz (MHz) of bandwidth and is an affordable medium for data transfer.

7.4.2 Video Cable for CATV, TV, DSS, and Video Monitoring: RG-6 Quad Shield Coax

For distribution of broadcast and cable TV, install RG-6 quad-shield coax cable. This will help avoid any customer dissatisfaction that can result even when your installation is done perfectly, but the cable choice wasn't the best. RG-59, once commonly used by cable companies for basic service, is now recommended only for very short component-to-component runs (such as behind an entertainment center). It is barely worth an installer's trouble to stock this second cable variety for such minor installations and much easier to stick with RG-6 quad-shield for all your coax needs.

If the installation calls for it, direct burial coax cable is available.

Installer's Tip: Remember, minimum industry standards can bring only passable results in some installations. For this reason, Leviton recommends higher quality structured cable for your installations.

7.4.3 Power Cable for Video Home Monitoring Camera: Category 5 or 5e UTP

Run both a RG-6 quad shield cable for video signal and a Category 5 or 5e cable for power to each potential camera location. In lieu of two separate cables, a composite cable containing both can be run. Remember to leave enough extra length at each end to separate the connections later. Since the video sequencer can handle up to four cameras, it's a good idea to plan four camera locations and pre-wire to them.

7.4.4 Speaker Wire for Multi-Location Stereo

Speaker wire ranges from a concert blasting 8 AWG stranded silver copper cable to a more modest 22 AWG copper, but the minimum accepted gauge for high-fidelity reproduction is 18 AWG copper (remember, the heavier the wire's gauge the lower the number). Leviton recommends a 16/2 or better stranded copper, class 2 cable. Class 2 refers to the cable's fire rating and it is the minimum acceptable by the NEC. Only use wire cable marked with at least a CL 2 or CL 3 rating. Plan to pre-wire to all volume control and speaker locations. It is best to run speaker wire separately from other low voltage cabling.

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Installer's Tip: An audio system's performance is determined in part by the amount of resistance in its speaker- amplifier circuit, which consists of the speaker inputs, amplifier outputs, and the wire between them. Generally, this resistance—also known as impedance—rises as the distance between the amplifier and speaker increases, and becomes a real factor in multi-room audio distribution. Be sure to follow the speaker manufacturer's guidelines for wire gauge (this will be affected, in part, by the distance between the speaker and the amplifier) and the amplifier manufacturer's recommendations for acceptable impedance loads. Too small of a gauge will result in substandard speaker performance.

7.4.5 Infrared (IR) Remote Control Target and Emitter Cable

Connect Infrared components with additional runs of Category 5 or 5e cable to each IR target and IR emitter location.

7.4.6 High-Speed Optical Fiber Cable

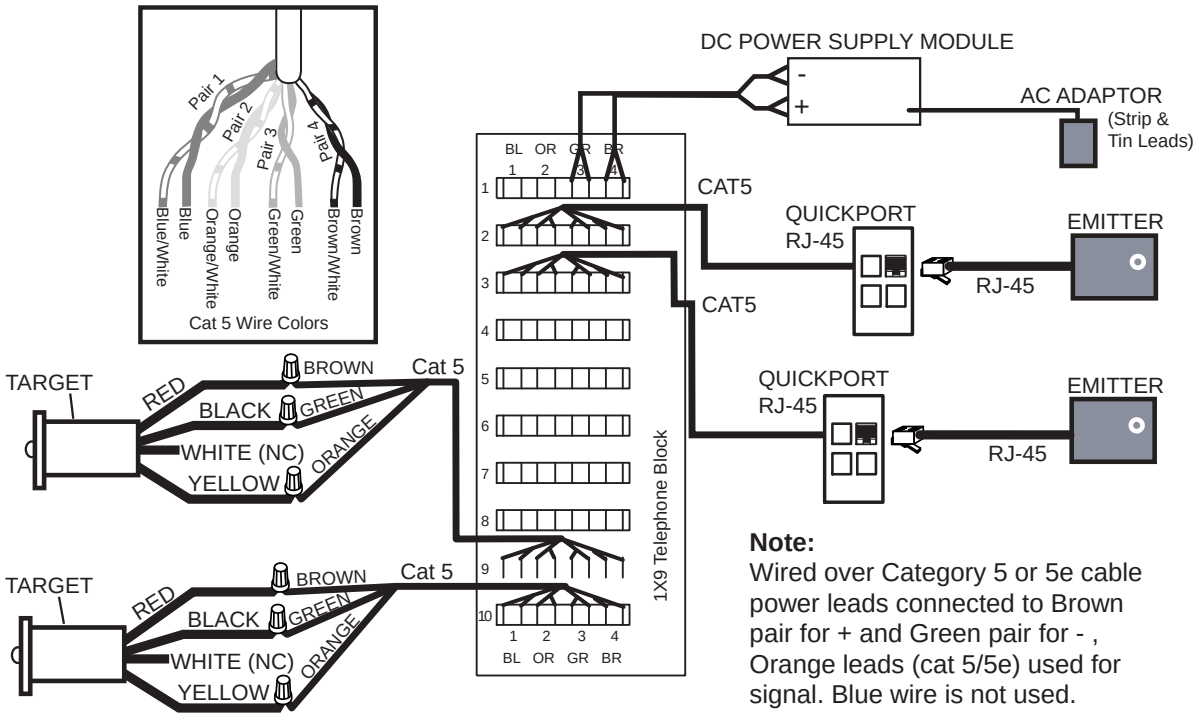
Although this manual does not deal directly with high-speed optical fiber cable, we recognize that an installer might be asked to install it as a primary system or as an addition to an existing one. Optical fiber converts electrical video/data/voice signals into pulses of light that are then beamed through a thin glass cable. The advantages to optical fiber cable include:

- Noise immunity (it is not affected by electromagnetic induction or EMI)
- Low signal loss
- No short circuits as it does not carry an electrical current
- The ability to carry more data, faster, with much higher bandwidth, than copper

The TIA-568-A standard recognizes two fiber optic cables:

- 62.5/125mm multimode optical fiber
- 9/125mm singlemode optical fiber

Multiple Targets & Emitters Using Bridge



Note:
Wired over Category 5 or 5e cable power leads connected to Brown pair for + and Green pair for - , Orange leads (cat 5/5e) used for signal. Blue wire is not used.

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Leviton offers a complete line of fiber optic terminations and patching alternatives. For more information, please contact Leviton Technical Support at (800)-722-2082.

Take Note: Your local code ultimately determines the rules and guidelines that must be followed when installing either AC cable or low-voltage wiring. Always refer to this code before starting your installation

7.4.7. Non-Metallic Tubing for Future Cable Runs

Although few codes call for running low-voltage cable inside conduit, this protective tubing does offer some advantages. Installed empty conduit allows future changes to the system without tearing into walls or ceilings. All the installer needs to do is leave a pull string in the conduit for pulling through cable at a later date.

Plan to run one conduit from the demarcation points to the SMC, another conduit from the SMC to the attic area, and another conduit from the SMC to the basement or crawl space.

ENT Flexible Conduit

ENT flexible conduit is low cost, and easy to install as it does not require solvent soldering. One-inch or one-and-a-half inch tubing will easily take care of future cabling.

Plastic Conduit

Nonmetallic PVC conduit is joined in sections with special fittings that are attached with a solvent-type cement. This is a very sturdy material that might cause some installation problems if its configuration cannot accommodate minimum bend radii for low-voltage cable. Again, always install a pull string when installing this or any other conduit for future wiring purposes.

Take Note: Never run low-voltage wiring inside the same conduit as AC. Always maintain at least minimum recommended separation between the two types of cable.

7.5 Wallplate Configurations

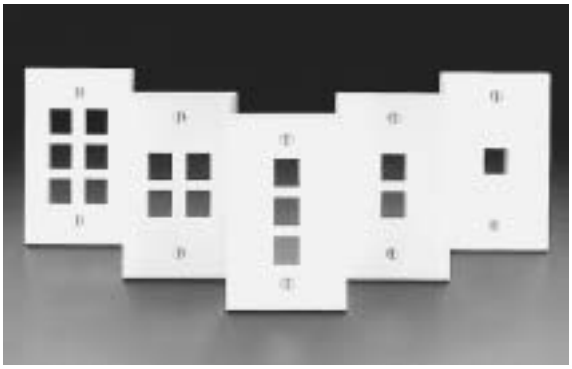
Structured wire wallplates must accommodate a variety snap-in modules and devices. Leviton offers both single-piece wallplates already configured for a set number of modules and one-and two-gang wallplates that can accept 2-, 3-,4-,or 6-port inserts. The Leviton wallplates described in the following sections fit these devices:

- Telephone, fax, and data ports (Category 5 or 5e jacks)
- Standard Video ports (F-connectors)
- DSS with Video and Telephone (F-connectors and Category 5 or 5e jacks)
- Speaker terminals (binding posts)
- Audio/video jacks (RCA's and BNC's)
- Infrared remote control emitters (Category 5 or 5e jacks)

7.5.1 QuickPort™ Flush-Mount Plates

These wall plates come pre-configured in a single-gang housing. The following flush-mount configurations are available in either ivory, white, or almond:

- 1-port
- 2-port
- 3-port
- 4-port
- 6-port



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7.5.2 QuickPort™ Decora Plus™ Wallplate Inserts and Wallplates

The Decora system offers the maximum in configuration flexibility, that is, they come as single-or double-gang wallplates and accommodate 2-, 3-, 4-, or 6-port inserts that secure any combination of QuickPort“ Snap-In Modules you desire. Inserts are sold separately from wallplates. Decora inserts can be mounted in multi-gang Decora wallplates for applications requiring higher density terminations than are possible in a single wallplate.

All Leviton wallplates are UL listed, conmform to NEMA and ANSI standards, are easily cleaned, and come with mounting screws.

7.5.3. Wall Mount Telephone

Use the Type 630A Screw Terminal Jack that includes a snap-on wallplate in ivory or white and mounting screws.

7.6 Structured Media Center

The Structured Media Center (SMC), as previously noted, is the distribution point for your low-voltage wiring needs. It is a single, secure, and convenient housing for your Leviton distribution modules, hubs, and enhancement hardware. There aren't many hard and fast rules regarding the location of the SMC, but there are guidelines.

7.6.1 General Location

The SMC can be located in any well-lighted area that will give you clear access to it and allow you to easily remove the protective cover.

The SMC should not be located:

- On an outside wall
- In an un-insulated garage wall
- At an extreme distance from connections at wall plates
- Next to main AC panel

Following some of the NEC (Section 110-26) rules for the placement of a service panel:

- Do not install your SMC above major appliances, such as a clothes washer
- Avoid moist locations, such as a bathroom, or in a wall over a sink
- The space in front of the SMC should not be used for or cluttered with stored items

Mount the SMC in an area central to the rooms that will be served in the home. This to keeps all the cable runs as short as possible to assure better system performance. Remember, all Category 5 or 5e cables must be no longer than 295 feet conductor length!

TIA-EIA-570-A recommends that an electrical outlet be near your SMC for Grade 1 installations and mandates it for Grade 2 installations.

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Take Note: Both the Essential and Enhanced platforms using the SMC 280 and 420 units incorporate an optional AC Power Module with hospital grade surge protection. This module should be wired with a dedicated 15 amp circuit. The SMC 100 and 140 do not incorporate an AC power module.

TIA/EIA-570-A calls for a low-voltage distribution panel to be located within five feet of the building's electrical ground.

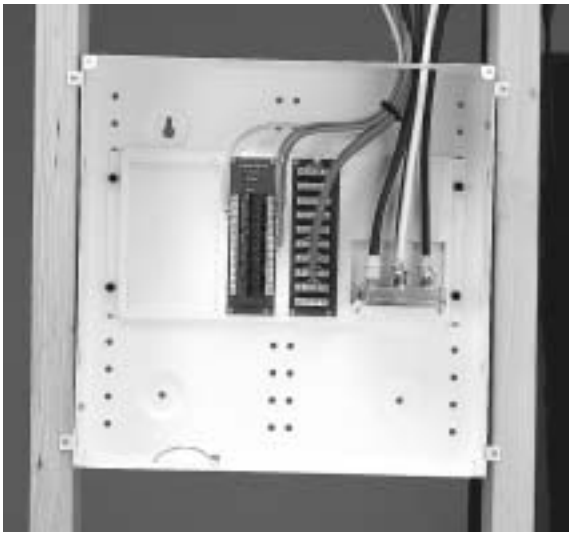
7.6.2 Height Above the Floor

You want your SMC at a serviceable height for most technicians. This means the top of the panel will be at approximately 5' from the floor.

7.6.3 Horizontal Location

Be sure that the SMC is not installed in the same stud space as an AC cable.

Installer's Tip: The further away from your electrical service panel that you can locate your SMC, the better. You want to keep electromagnetic induction (EMI) to a minimum. A five-foot separation is considered minimum. Mount the SMC in an accessible, centrally located, interior wall that does not require a 2-hour fire rating.



7.7 Structured Media Components and Devices

The neat and orderly placement of modules, hubs, and cable within a Structured Media Center accomplishes several goals:

- It's easier for the installer, client, and inspector to review the work
- The installer can better trace the system and any problems that might arise
- It establishes a standard installation procedure that can be followed on future jobs, thus cutting down on training time

Standardizing your installations allows you to do a better job and cut down on your punch list time.

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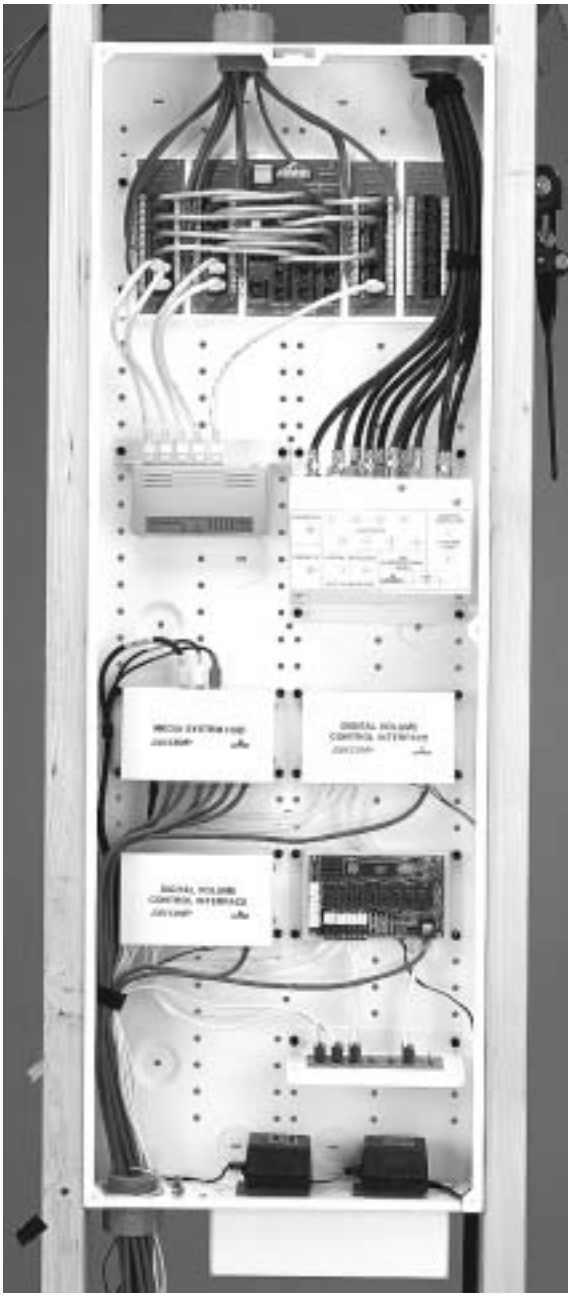

7.7.1 Recommended Placements of Cables and Components

For the most efficient use of internal space, Leviton recommends the following placements in the SMC:

- Coax cable on the right
- Data and phone in the center
- Audio cable on the left
- AC and DC power modules on the bottom of the enclosure
- Pre-Configured Structured Cabling Panels in the upper section of the enclosure

All components should be installed in such a way that cable bends are sweeping and gradual rather than at right angles. The installer should employ good cable management practices to avoid twisting and kinking.

7.8 What you need to know

- Lay out your floor plan, including device locations and cable routing, before starting any structured cable installation; review your plan thoroughly with your client.
- Plan Essential or Enhanced Infrastructure wiring (phone, data, and coax video), plus any additional wiring needed for applications (multi-location stereo, home monitoring, multi-room video, etc.)
- Install an appropriate size SMC for current use and future expansion.
- Use mud rings whenever possible instead of standard electrical boxes.
- Follow TIA/EIA standards for device locations and cable selection.
- Install your SMC components and cables in an orderly manner as per Leviton's recommendations.

Installer's Checklist

Cable Usage	Recommended Type
Telephone and Data	Category 5 or 5e UTP
CATV, TV, DSS, and Monitoring	Quad Shielded Coax
Video Monitoring Camera	Category 5 or 5e and RG-6 quad shield coax cable
Speaker Cable	Minimum 16/2 stranded copper, class 2

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PRE-WIRE

8 Installation, Labeling, and Documentation Pre-Wire Installation

The integrity of any electrical wiring system is highly dependent on the quality of its installation. Even the very best components will perform poorly if they are installed incorrectly or carelessly. Every step of the installation, from running the cable to installing the wallplates, should be done according to code and industry standards. This section will address these installation procedures. *It is in the installer's best interest to follow these procedures to avoid callbacks and repairs to the system!*

Category 5 or 5e, unshielded twisted-pair (UTP) cable is the mainstay of low-voltage wiring. Even though its four pairs of wire are color-coded, there can still be some confusion when installing them at terminal devices or when future changes are done to the system. Add to this multiple terminal devices, coax cable, and any other existing UTP cable and the importance of labeling each cable becomes self-evident. Labeling and documentation will assist in troubleshooting and making future changes to the system. Section 8 will discuss appropriate labeling and documentation for low-voltage systems.

8.1 The Walk-through

A pre-installation walk-through during the framing stage will do the following:

- It better familiarizes the installer with the job
- It allows a comparison between the plans and any changes to the building construction
- It allows the installer, general contractor, designer, and customer to alter the proposed installation or head off any foreseeable problems or conflicts
- It gives the installer an opportunity to formulate a work plan

If the installer is a separate contractor from the electrician, the two contractors will have to coordinate their respective installations to avoid problems with locating devices and sharing stud and joist spaces. In fact, the installations of AC and low-voltage wiring are often done at the same time. If they are done separately, the low-voltage follows the AC.

A walk through also allows the installer to mark off locations for mud rings and the SMC. At this point, the rough-in wiring can begin.

What You'll Need for Your Walk Through:

- Your original Leviton Connection Planner
- Notebook or pocket recorder to note any changes and additions
- Builder's plan

8.1.1 The Reality of the Job and the Installation

The definition of the ideal job depends on the trade. For an electrician or an installer of structured cable, it would mean unfettered access for routing cables and no damage to their work by other contractors trades. A realistic installation will go like this:

- The low-voltage cable is carefully installed, observing all routing and handling rules and standards, and then visually inspected
- Any damaged or questionable cable is replaced, never spliced and repaired
- Steel nailing plates are installed anywhere the cable can be damaged by a screw or nail through a framing member
- Both ends of each cable run are left with sufficient excess cable and service loops that are then wrapped and protected in plastic bags or similar material until other trades have finished their work
- At that point, the cables are connectorized and tested and the system is checked for damage; if damage is detected, the installer then negotiates the repairs with whomever caused the damage
- The best way to avoid damage and costly repairs is to protect all your cables and regularly discuss and drive home to other trades the importance of protecting these cables as well (you also want them to report any damage to you when it happens so you can repair it while the walls are still open)

Installer's Tip: No job will go flawlessly, but good communication skills coupled with your own vigilance will keep problems to a minimum.

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What You'll Need to Install Mud Rings or Electrical Boxes:

- Room locations for mud rings or boxes
- Measuring tape
- Small carpenter's level
- Screws or nails for attaching to framing members
- Drill or hammer

8.2 Mud Rings

Leviton recommends using mud rings rather than receptacle boxes to terminate your low-voltage cable. Aside from acting as mounting hardware for a device and wallplate, a mud ring allows complete access to the stud or joist space for storage of the service loop which in turn means less danger of damaging the cable. Mud rings are available at electrical distributors, home centers, and wherever drywall supplies are sold.

In some localities, the code mandates electrical boxes and conduit for low-voltage wiring. Always check your local regulations before installing low-voltage cable.

If electrical boxes are required, use the deepest 4-square boxes available to allow for cable bend radius and service loop.

8.2.1 Location of Mud Rings

Every wallplate location will require a mud ring as will any empty conduit run for future wiring purposes. The floor plan will indicate specific locations. Mud rings should be located away from AC wiring and devices, baseboard heaters, and potentially wet areas such as sinks. Distances from the floor will be determined by:

- Convention, using AC standards
- Specifics of the job
- Matching existing devices

8.2.2 Mounting

Metal mud rings are typically nailed to framing members prior to the installation of drywall. Retrofit or low voltage rings can also be installed in existing walls during remodeling work. Use a small carpenter's level when mounting to assure a level and straight installation.

The bottom of the mud ring opening should match the height of the bottom of electrical boxes for consistency. This height varies from approximately 14" to 16" from the floor for most walls. A height of 46" to 48" is used for volume controls, wall phones, and other hand control devices, or at the same level as light switches. Special locations such as built-in cabinets and shelves for home entertainment systems may require other heights. Be sure to check with your builder for any special instructions.

Installer's Tip: Even the best technical installation can be marred by sloppy trim work. A crooked mud ring will yield a crooked wallplate and that's what your customer will see every day. Take your time and mount the mud rings carefully.

8.3 Structured Media Center

The Leviton Structured Media Center (SMC) is the distribution center for your project's telephone, cable, and data features. The SMC centralizes these various functions in a single box that can accommodate future expansion to meet your customer's needs. This section will cover selecting an appropriate location for your SMC, proper mounting procedures, and installing the optional AC Power Module.

8.3.1 Location Matters

Each job and building design will determine the location of your Leviton SMC. Location guidelines were mentioned in Section 7. To summarize:

1. Do not mount the SMC in a fire-rated wall.
2. Choose a dry, well lighted room
3. Be sure you have convenient access to your SMC for future additions of structured cable
4. Keep a minimum distance of five feet between the SMC and the service panel
5. If possible, consider a central location that will result in the shortest distance between the SMC and the structured cable termination points
6. Mount the top of the panel approximately 60" from the floor.

A room over an unfinished basement or crawl space or under an open attic space will allow structured cable to be installed in the SMC at a later date if expansion or updates are desired. Typical locations include utility rooms, closets, and basements, but any room can be used.

Installer's Tip: An open, clear space in a closet makes a fine location for an SMC. It also allows the contractor to install a removable wood panel above and below the SMC, thus providing access to the wall cavity. This makes future cable installations considerably easier.

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8.3.2 Mounting your SMC

There are two ways to install a SMC:

1. Flush-mounting between wall studs

2. Surface-mounting

What You'll Need to Mount Your SMC:

- Tape Measure
- Drill and bits
- Mounting screws
- Hammer
- Pencil or marker
- Shims
- Plywood or 2X4s (for surface mounting)

To flush-mount a SMC:

- Remove required knockouts from the unit prior to installation
- Allow twelve inches of access above and below the unit for conduit fittings, cable routings, and, if called for, the installation of power module
- Position the SMC unit so that its top is about 5 feet above the floor.
- Hold the unit between the wall studs with tabs, moving it out against the studs to accommodate any dry-wall installation
- Mark the knockout locations on the wall studs if using side-wall knockouts.
- Remove the SMC and drill out the studs at the knock-out locations
- Insert the SMC between the studs
- Install the wood screws that come with the SMC through the mounting holes. Shimming may be required if studs are warped or twisted.

Installer's Tip: Use the cardboard mud guard to cover and protect the interior of the box and unterminated cables during dry wall finishing. The mud guard will defray damage from other contractors and workers on the job. Store the SMC metal cover, in its original plastic protective covering, in a safe place until ready for trim-out.

If you surface-mount the SMC:

- Provide some structural support in the form of bracing (such as 2X4s between the studs or a piece of 3/4" plywood)
- Remove any required knockouts from the back of the box

- Position the SMC unit so that its top is about 5 feet above the floor.
- Install the wood screws through the mounting holes on the back of the unit, tightening them securely to the plywood or framing

Be sure that a light fixture is installed near the SMC.

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8.3.3 Grommets or Plastic Bushings

Leviton requires the installation of protective grommets or plastic bushings at every SMC knockout. Knockouts are sized for 1-inch and 1-1/2-inch conduit fittings. This protection will prevent damage to the cables as they enter the SMC. Without grommets or bushings, the insulation on the cable can tear or otherwise be compromised if it is pulled against the bare steel edge of the opening.

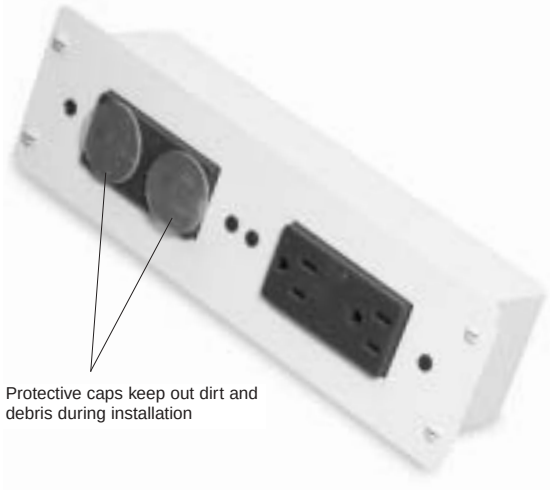
8.3.4 Cable Entry to the SMC

Cables typically enter and leave from the top of the SMC (AC power cables, for the AC Power Modules available on the SMC 280 and 420, enter through two knockouts on the bottom of the module).

8.3.5 Powering

The Leviton SMC is designed as a distribution device for *low-voltage wiring only*. It is not designed for the installation of standard AC cable or Romex. When power is required for distribution modules, a Leviton *AC Power Module* is installed. The *AC Power Module* has the additional benefit of providing surge protection for the distribution modules.

Take Note: Never wire live AC cable. The circuit must be disconnected at the power source and confirmed with a tester. Communications wiring and components should not be installed during lightning storms or in wet locations (unless specifically designed for such locations). An installer should never touch uninsulated wires or terminals unless the wiring has been disconnected at the network interface. Only a licensed electrician, or in some cases a home owner, must connect the AC Power Module.



Protective caps keep out dirt and debris during installation

8.3.6 AC Power Module

The *AC Power Module*, which fits into an opening at the bottom of the SMC, consists of two 15 AMP Hospital Grade Transient Voltage Surge Suppression (TVSS) outlets inside a steel enclosure. Some features of the *AC Power Module* include:

- A green indicator light showing that surge protection is in effect
- An audible alarm that is set off when the indicator light flashes, signifying that the receptacle is no longer offering surge protection. The device continues to function as a standard AC outlet at its 15 amp rating.

The alarm can be shut off, but it cannot be reset! The Power Module must be replaced in order to maintain surge protection.

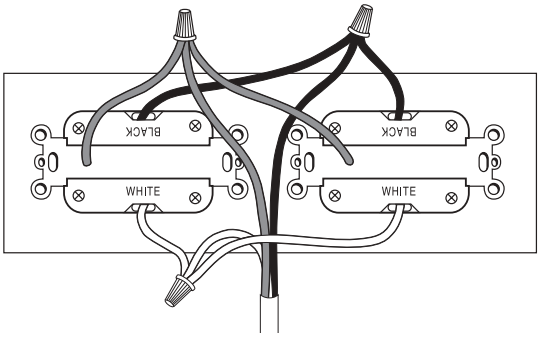
8.3.7 Installing the AC Power Module

Like any piece of electrical equipment, the AC Power Module should be installed following all appropriate electrical codes and safety precautions. These include:

- Running a dedicated 15 amp circuit to the SMC (some installations might call for two dedicated circuits depending on the continuation of power to certain SMC devices in case one circuit is inadvertently tripped.)
- Using 14/2 or 12/2 Romex
- Being sure that the power to the circuit is *off* before wiring the *AC Power Module*
- Using only copper or copper-clad from the power source
- Understanding that the *AC Power Module* cannot act as a lightning arrestor (it will not survive a direct lightning strike)

The accompanying diagram shows the installation of a Leviton *AC Power Module*:

1. Remove the large rectangular cover plate at the bottom of the SMC panel



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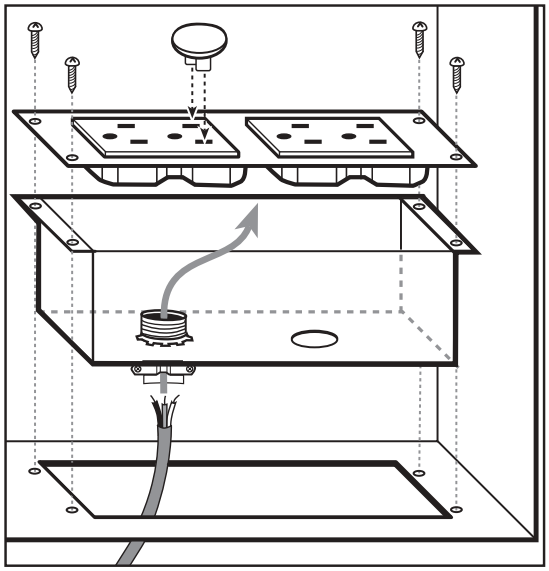


2. Punch out one or both of the cable entry knockouts that are also located at the bottom of the module housing and pull your cable(s) through

3. Secure your electrical cable with a standard conduit fitting or cable clamp (not included)

4. Drop the housing into its opening

Next, connect the incoming power cable to the surge suppressor receptacles. the wiring connections will depend on whether one or two dedicated circuits are being run to the *AC Power Module*. The diagram on the previous page shows the installation of the receptacles using the single cable of one dedicated circuit:

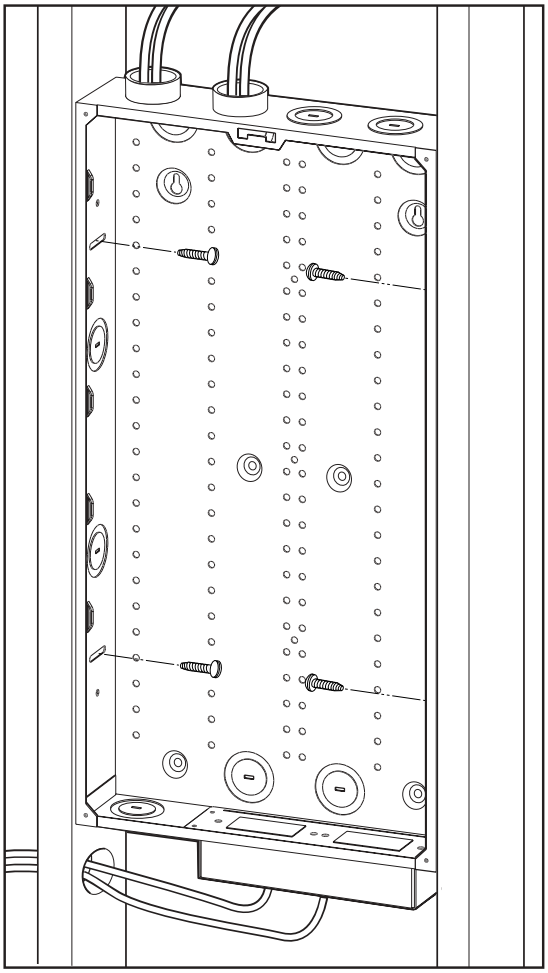
1. Attach a "pigtail" or short piece of white NEUTRAL (N) conductor to the SILVER terminal screws on each receptacle. These screws are located on the sections labeled WHITE on the back of the receptacles.

2. Twist the two white pigtails together with the white or NEUTRAL conductor from the incoming power cable, securing the ends with an appropriate wire connector.

3. Attach a black or HOT pigtail to each BRASS colored terminal screw on the back of each receptacle. These screws are located on the sections labeled BLACK on the back of the receptacles.

4. Twist the two black pigtails together with the black (HOT) conductor from the incoming power cable, securing the ends with an appropriate wire connec tor.

5. Twist the GREEN ground leads from the receptacles with the GREEN or BARE copper grounding



conductor from the incoming power cable, securing the ends of the wires with an appropriate wire connector.

6. Carefully place the receptacles into the housing, being sure that all wiring is safely tucked inside the housing.

7. Secure the AC Power Module to the SMC using the four #6 X 3/8" screws that come with the module, tightening the module securely; these screws also secure the module's housing to the SMC.

8. Test the module by turning the power to its dedicated circuit(s) on at the service panel.

9. Until the work is completed, install *safety plugs* into the receptacles to protect them from construction debris.

If you're installing two separate dedicated circuits, each incoming cable will connect directly to a single receptacle without the use of pigtails or wire connectors.

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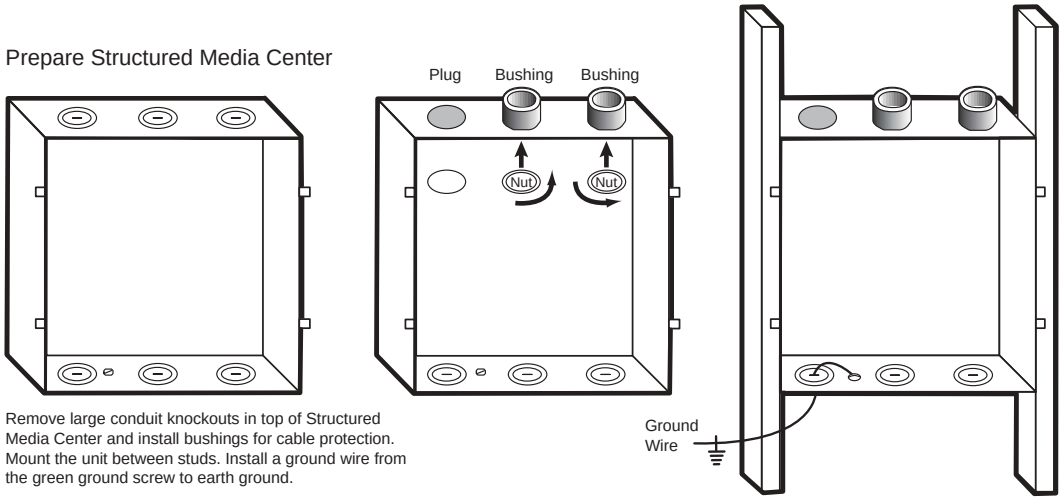
Structured Media Center Installation and Wiring Instructions

Prepare Structured Media Center



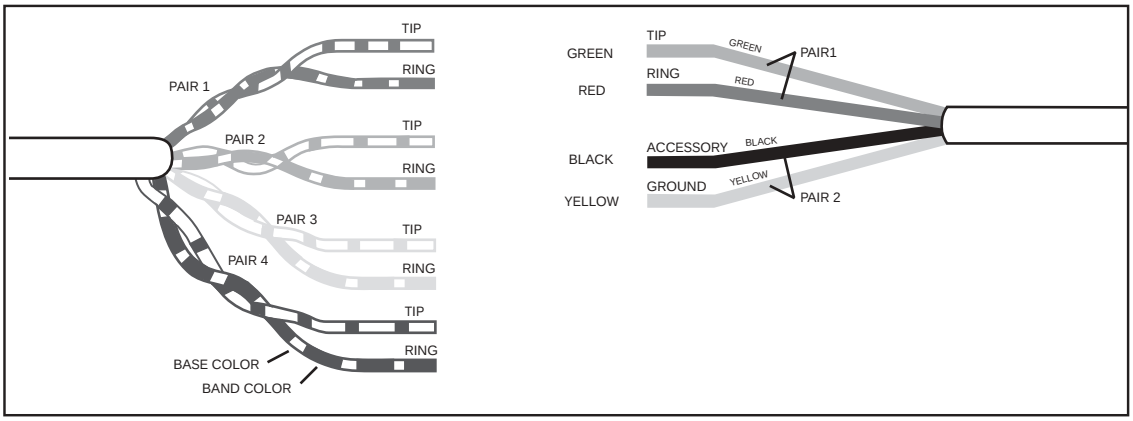
Remove large conduit knockouts in top of Structured Media Center and install bushings for cable protection. Mount the unit between studs. Install a ground wire from the green ground screw to earth ground.

8.3.8 Grounding the SMC

A grounding lug can be found at the bottom of the SMC. An appropriate ground wire should be secured between the grounding lug and an earth ground point, such as a grounding rod or a grounded metallic water pipe. Insert the ground wire into the lug and tighten with a screwdriver. A minimum No. 10, solid conductor, bare copper wire is recommended to ground the unit.

8.4 Structured Cabling (Pre-Wire)

A Category 5 or 5e compliant installation involves more than simply the use of Category 5 or 5e cable. For full compliance, jacks and cable must meet EIA/TIA 568-A electrical and mechanical specifications and transmission requirements. A Category compliant installation will minimize the attenuation, near-end crosstalk (NEXT), return loss and signal-degrading factors that can greatly affect a system's transmission ability. Category compliance can be altered by the method of installation. Improper cable routing and support, as well as kinking, stretching, and crimping all negatively affect the cabling performance. Proper cable installation is critical to system integrity.



Category 5 or 5e Cable (New) *Quad Wire (Old)*

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In the past, the main low-voltage appliance in a home was a telephone. The other was the doorbell. Known by the acronym “POTS” or Plain Old Telephone Service, this system worked well for what would now be viewed as a basic, even unsophisticated single-line analog phone service. POTS used quad wire, consisting of four individual, non-twisted wires within a single cable jacket and run in a daisy chain pattern. This meant that a single wire served a long run of telephone jacks, if not all of the jacks in a home. Damage to the line could take all or many phones out of service.

Installer’s Tip: Quad wire is not an appropriate conductor for modern multi-line installations, and will result in poorly performing telephone/modem/fax services, and will not allow high speed data network communications. If you run across it during remodel work, replace it with Category 5 or 5e structured cabling. Any quad wire in a Category 5 or 5e 5 installation makes the entire wiring system susceptible to noise. The NEC has now made the use of Quad wire illegal.

Structured cable systems are not only more sophisticated than quad wire, but they use a different routing pattern as well.

8.4.1 Cable Topology

The daisy chain wiring pattern has been replaced with the star pattern, also known as the home run. With the star wiring method:

- Each device is wired directly to a distribution center (the SMC)
- Service affecting problems are isolated to a single cable and thus a single device
- Troubleshooting and repair are easier because the damage can be isolated

TIA/EIA-570-A calls for star topology in residential and light commercial cabling systems.

Cable from the SMC

Be consistant in your cable routing at the SMC. Using the knockouts at the top of the SMC, keep camera, telephone, data, and IR cable (Category 5 or 5e) to the left. Keep speaker wire separated. The right side is for video cables (RG-6 quad shield).

Note that additional runs of Category 5 or 5e cable may be needed for Home Monitoring, Multi-Room Video, and other applications. These cable runs are above and beyond the minimum cabling for the Essential and Enhanced infrastructures.

Warning: Grounding and bonding systems are an integral part of low-voltage cabling. Improper grounding and bonding can induce voltages that disrupt telecommunications circuits. Grounding and bonding must conform to all local codes and conform to TIA-607 requirements for telecommunications infrastructure. Manufacturers’ instructions should also be followed.

Conduit for Future Installations

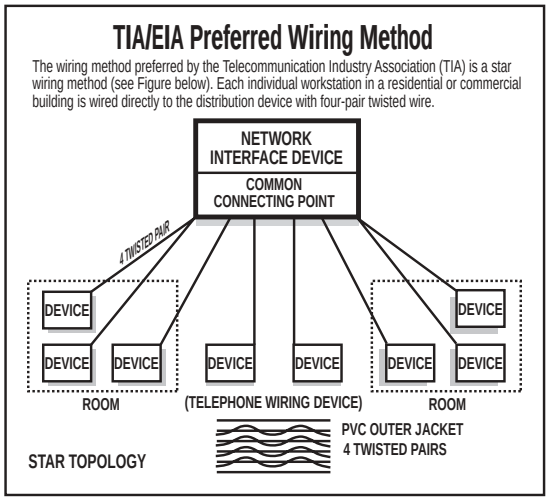
Structured wiring will be a part of every new home at some point in the near future. More and more uses and devices will fuel customer demand. The system you install today might need enhancing and upgrading later on. For these reasons, Leviton and many contractors recommend the installation of empty conduit during the framing stage so that it will be available for future cabling. One of the best choices, and easiest to install, is ENT flexible conduit in either 1-inch or 1 1/2-inch sizes. It should be routed from the SMC:

- to the crawlspace or unfinished basement (if any)
- to the attic
- to the service entrance point (for telephone and cable service

Be sure to install a pull string inside each run of conduit to assist in future cable installations.

8.4.2 Cable Routing, Dressing, and Strain Relief

Category 5 or 5e cable is manufactured to deliver high-speed performance to multiple end points. Category 5 or 5e cable does its job best when it’s handled appropriately. It is not a forgiving material medium that can be pulled, stretched, and stapled the same way as standard romex. A light touch on the installer’s part goes a long way towards guaranteeing system integrity and performance.



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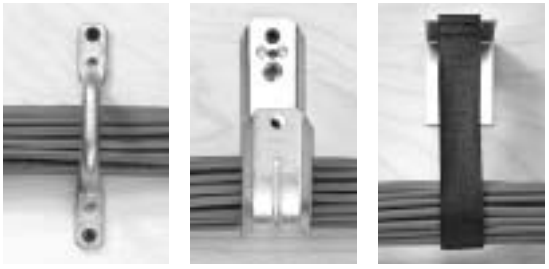
Leviton recommends the following materials for cable installations:

- J-hooks and similar cable supports instead of staples for supporting cable along joists
- Cable clamps on individual cable runs
- Velcro, tie wraps and cable straps for wrapping multiple cables and for securing cable to studs (Leviton SoftCinch, or equivalent)
- Leviton Cable Joe, Clamp-on Cable Router for smoothly routing up to 20 cables around corners without damage

Standard staples are not recommended. The methods recommended here are more forgiving. The cost of time spent tracing down and replacing one damaged cable will surpass any lower material expense or labor cost saved by using less expensive staples.

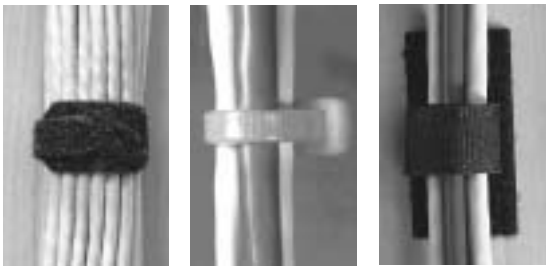


Use j-hooks or similar devices designed to support cables.

Staples by hand, or use staplers with depth stops.

Use Velcro® to keep cables from becoming over-cinched.

Use tie wraps loosely on large bundles. (See 'Using Tie-wraps')



Use Velcro® tie wraps and cable straps to secure large bundles.

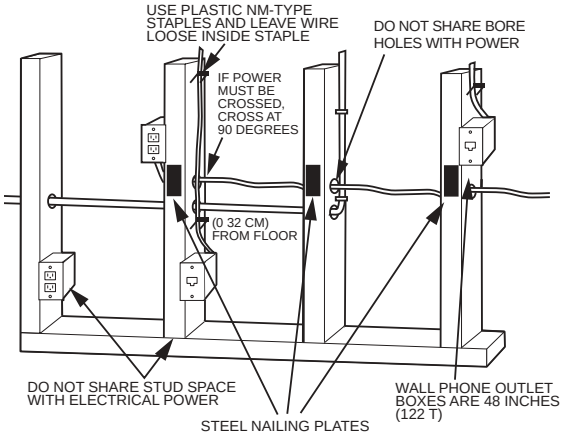
Installer's Tip: An insulated staple is an ideal fastener for low-voltage wiring. The insulation acts as a built-in stop that prevents the staple from crushing or stressing the cables. Be sure the cable diameter does not exceed the staple's capacity.

Pulling Low-Voltage Wiring Through Wood and Metal Framing Members

Like standard AC cable, low-voltage wiring will run through holes in wall studs, floor joists, and rafters.

Leviton recommends a minimum 1" diameter drill hole in framing members for running low-voltage cable. This allows for bundling multiple wires without constriction and reduces pulling stress in the cables. Although NEC rulings for protecting electrical cable apply to AC conductors, structured cable systems can be protected the same way. These rulings state:

- Cable running through framing members must be 1 1/4" or further from the nearest edge of that framing member (Section 300-4[a][1] and [2])
- If a cable cannot meet the 1 1/4" rule, it must be protected by a steel nailing plate attached to the edge of the framing member
- Cable running in intermediate and rigid metal conduit, rigid nonmetallic conduit, and electrical metallic tubing is exempt from the 1 1/4" rule
- Cable running through metal framing members must be protected by a bushing or grommet unless the cable is running inside conduit



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A single low-voltage cable running through a stud hole is unlikely to get damaged by a drywall nail or screw, but a bundle of cables would certainly be subject to damage. For the cost of some nailing plates, the nuisance and expense of replacing a damaged low-voltage wire inside a finished wall can be avoided.

It is especially important on vertical runs between wall studs that bundles of low-voltage cable be secured with Velcro® straps such as Leviton's *SoftCinch*™. When in doubt, you can never go wrong adding more support in the form of:

- J-hooks and similar cable supports
- Cable clamps
- Velcro® wraps and straps

Installer's Tip: The NEC calls for the distance between an electrical box and the first strap or staple securing AC cable to not exceed 12 inches. This rule does not apply to low-voltage wiring and in fact would prevent you from leaving a service loop securely tucked inside of a wall.

8.4.3 Cable Bend Radius

Low-voltage cable is not as physically hardy as heavier AC cable. 12/2 romex, for instance, can be bent at much sharper angles without hindering its performance than can any low-voltage cable. TIA/EIA-570-A (sections 8.2.1 and 8.4.1) sets out a very specific bending radius for UTP cable and coax cable. Essentially, they state that you should avoid sharp or right angles and make as sweeping a bend as you reasonably can with either of these cables. The cable bend radius for Category 5 or 5e cable must not be less than 4x the cable diameter or about 1-inch. The bend radius for RG-6 quad shield coax must not be less than 10x the cable diameter, or about 3-inches. The bend radius for fiber cable must not be less than 10x the cable diameter. These sweeps should be maintained both in your cable runs and at termination.

Don't allow cable to form right angles or sharp bends

Use sweeping bends

Note: *When pulling Coaxial or Optical fiber cable, maintain a minimum bend radius of 10x the cable diameter or about 3 inches.*

8.4.4 Service Loops

Mud ring installation gives the installer access to the stud space. This in turn allows for a service loop, or extra cable, to be stored in the wall and made available in the event of:

- Damage to the wire at its termination
- A change of devices
- Errors when installing a jack

Leviton recommends:

- A 24-inch minimum service loop for Category 5 or 5e, RG-6 quad shield coax, and speaker wire
- A 36-inch minimum service loop for fiber cable
- Make sure the service loops are larger than the minimum bend radius for each type of cable (Category 5 or 5e: 4x, RG-6 and Optical fiber: 10x)

8.4.5 Labeling

It is critical that low-voltage cable be properly labeled. The last thing an installer wants is to trace an errant connection or incorrectly placed wire because it isn't identified or identified properly. Good labeling will include:

- A master list or index of all cables
- A letter or number system for identification
- A label on both ends of all cables

Installer's Tip: One method for cutting down the confusion of multiple Category 5 or 5e cables is to use one color of sheathing for your phone system and a second color for data and networking. The cable is all the same, but two different colors (say, blue and gray) make it easier to keep track.

8.4.6 Label Placement

Labels should be placed near to the termination point but far enough from the end to remain readable after termination. The label should clearly identify each pair of twisted cable, for instance, and stay clear of the Category 5 or 5e jacks. Attaching a label to each end of the cable, both at the SMC and behind the wallplates, will greatly simplify identification later. Either write your numbers or letters clearly in permanent ink or, affix pre-printed labels. Computer-generated labels

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would also allow you to keep a paper copy of the labels for your client's records. Letter and number cable identifiers are available from Ideal, Titan, and other label manufacturers.

8.4.7 Wiring Chart

Every AC installation comes with at least a rudimentary circuit map attached to the door of the service entrance. Your SMC serves the same purpose as a location for a wiring identification chart for your low-voltage system. This chart (see page 8-12) should include pathways for:

- Category 5 or 5e cables for telephone and voice/ data distribution
- Coax cable for video distribution
- 16/2 or 14/2 Type CL-II stranded copper wire for speaker wiring
- Other wiring or cable (for example, fiber)

Installer's Tip: For an even more foolproof identification, duplicate labels can be placed on the inside of the wallplate.

A wiring chart should refer to the rooms or sections of the house where the end-point devices are located in such a way that anyone can identify those areas. Simply to state "Bedroom #1" can be misleading to a future homeowner or technician. The chart should employ more accurate directions, such as "2nd floor NW bedroom," to avoid confusion. An example wiring chart is shown on page 8-12.

8.5 Pre-Wire for Individual Devices

Each end-point device calls for its own wiring requirements such as cable type and location. The following summarizes these requirements:

- Run Category 5 or 5e cable to every data and phone wallplate
- Run Category 5 or 5e cable to every IR target and emitter location and leave instructions for drywall installers that Category 5 or 5e cable of IR Targets (in ceiling or walls) should protrude through drywall without an electrical box or mud ring.
- Run two RG-6 quad shield coax cables to every TV/video outlet
- Run additional RG-6 quad shield and Category 5 or 5e cable to every camera location, checking mounting heights
- Run additional RG-6 quad shield and Category 5 or 5e cable to any location where multi-room audio/video is planned
- Run two cables of minimum 16/2 AWG speaker wire and a Category 5 or 5e cable from each volume control location to the SMC. Run one cable of minimum 16/2 AWG from each volume control to each speaker in the same room. A simple method for assisting drywall installers to accurately locate speaker wiring (without an electrical box or mud ring) is to attach cardboard to the appropriate wall stud or ceiling joist. Then, drill a hole in the cardboard at the desired location, just large enough to pull the speaker wire through.

Note: *You may have a higher cable count than needed for the number of connection points in the SMC. This approach enables future expansion and can save much time and expense in the long run.*

Installer's Tip: An alternative to individual Category 5/5e and coaxial cables is CEBus®, which stands for Consumer Electronics Bus. This is a communications standard for in home networks developed by the Electronics Industry Association (EIA) and the Consumer Electronics Manufacturers Association. CEBus houses twisted pair (TP) cable, coax cable, RF and infrared all under a single jacket. It's expensive and its major advantage is centralizing multiple media in a single cable.

8.6 Volume Control and Speakers Location Considerations

There is a certain science to the placement and installation of speakers for multi-room stereo systems. Generally, speakers should:

1. Face the typical sitting location of the listeners
2. Be located on the long wall of a room for accurate stereo imaging.

Once you have selected the best wall for speaker mounting, the rule-of-thumb is to mentally divide the wall into three equal vertical sections. The imaginary lines where any two sections meet are the best locations for the speakers (after you've taken into account furnishings, fireplaces, windows, and light fixtures). This method places the speakers roughly equidistant from the room corners (called boundaries) and from each other.

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In terms of height or distance from the floor, in-wall speakers have considerable flexibility as they are designed for wide dispersion. The wall/ceiling interface, however, is another room boundary. Placing a speaker too close to a room boundary can result in "doubling," or an excessively boomy sound. Today's sophisticated A/V receivers and audio processors can help correct some room-speaker interaction problems, but it is better to start from as sonically-correct a placement as possible

Take Note: Try to keep in-wall speakers at least 2' (24") from any room boundary, including the ceiling. The exceptions are soffit locations, where there might be a protrusion of a drywall space into the room. Because soffits represent extruded room boundaries, they can sometimes be used to the installer's advantage. Soffits also can include an archway, such as the one sometimes found between a living room and dining room or around a built-in fireplace. Often these built-in cavities can optimize an in-wall speaker and should be used whenever possible.

The Leviton 40890 series *Structured Media Speakers* are designed for permanent mounting directly to drywall for long-term sonic integrity. Speakers work by vibrating and can generate considerable mechanical force. Drywall is a good, acoustically-inert mounting platform and, unlike brackets and frames fixed to studs, will not loosen and rattle after extended use.

For surface-mounted speakers over drywall:

- Label the wire for the speaker location
- Record its location elsewhere in case the wire becomes covered over accidentally with dry wall.
- Secure the speaker wire to a nearby stud so it doesn't fall down the stud cavity
- Although no mud ring is required for surface-mounted speakers, a mud ring is required for the volume control

8.7 Wiring for the Decora Digital Volume Controls

Take Note: If more than one Volume Control Unit is to be connected to a Hub (where multiple units will be controlling the same speakers) the 8-wire connections to the Volume Control Units must be parallel.

- From each Hub, run a fire-rated 2-conductor speaker wire to each speaker (in the appropriate room). Then run a short 2-conductor speaker wire to the other speaker. Every speaker must have a home run speaker wire pair.
- From each Hub, run 1 Category 5/5e cable to each Volume Control Wall Unit in that zone. If there is more than 1 pair of speakers connected to a single Hub, the speakers can be wired in a series or parallel configuration inside the SMC. Choose the configuration that creates the closest to 4 or 8 ohms. Do not attempt to make the final impedance less than 4 ohms.
- Next, run a single fire-rated 4-conductor and fire-rated 2-conductor (or 3 fire-rated 2-conductors) 14-18 gauge speaker wires from the amplifier location to the SMC.

8.8 What You Need to Know

- Always do a complete walkthrough of the job with all interested parties (client, architect, general contractor) during the framing stage
- Clearly communicate your concerns to other trades regarding accidental damage to your work during the installation
- Unless they are in violation of your local codes, use mud rings instead of electrical boxes for mounting devices and wallplates and terminating the cables
- Choose a centrally located, dry, well-lighted room for installing the Leviton *Structured Media Center*
- The SMC is intended for low-voltage distribution only; any AC power needed for distribution modules is to be supplied by a Leviton *AC Power Module*
- Low-voltage cable routing follow many of the same standards as AC cable with the exception of support and strain relief which must follow the more specific standards outlined in this text
- It is very important that all low-voltage cable be properly labeled on both ends of the cable as well as on a wiring chart inside the SMC, even if that cable is for future expansion and not yet connected.

8.9 A SUMMARY OF INSTALLATION RULES AND PRECAUTIONS

Leviton wants your installations to be successful and error-free. Like AC installations, low-voltage wiring has its own guidelines and standards. By following them, you'll greatly cut your callback work and leave your customer satisfied and remembering you for all the right reasons.

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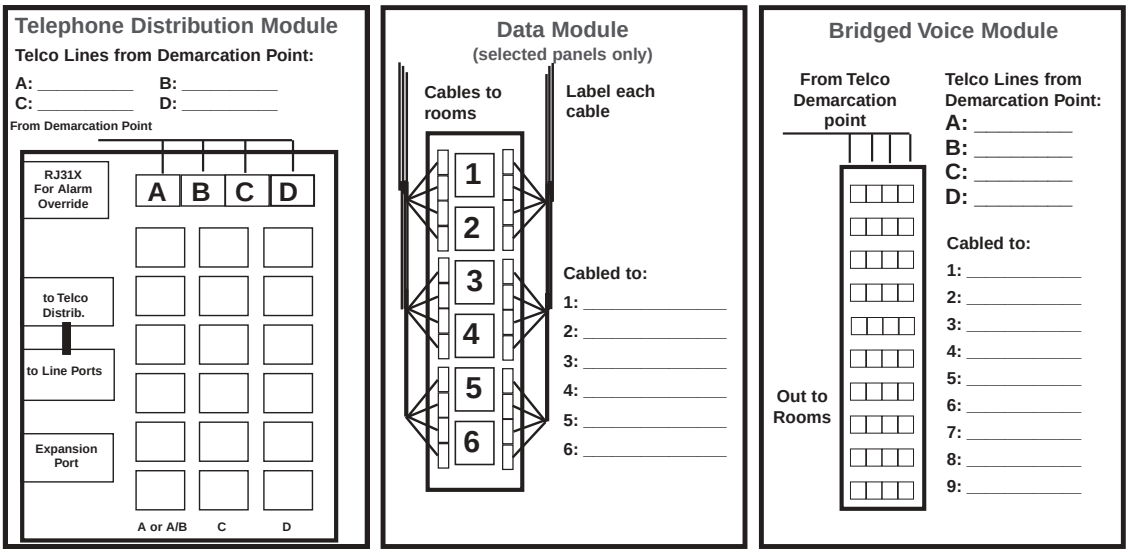

TELEPHONE DISTRIBUTION MODULE:

1. Run cable into enclosure from telephone demarcation point. 2. Punch pairs down using industry standard 110 tool; (A)wht/bl - blue pair/line one; (B)wht/or - orange pair/line two; (C)wht/gr - green pair/line three; (D)wht/br - brown pair/line four. 3. All three columns are now active with dial tone, use patch cords to link whichever line you need to the outgoing port on the Category 5 Voice/Data Module.

CATEGORY 5 VOICE/DATA MODULE:

1.Terminate (by punching pairs down with an industry standard 110 tool) individual outlet cables, one per connector. Label cables to identify locations they run to. Use "Cabled to" section to identify which Category 5 or 5e port corresponds to which cable. 2. Use patch cords to link the Category 5 or 5e ports to the Telephone Distribution Module or to a Network Hub.

BRIDGED VOICE MODULE:

1. Run cable into enclosure from telephone demarcation point. 2. Punch pairs down using industry standard 110 tool starting with the blue pair/line one. 3. Telco line is then bridged on the matching color only, to all remaining connectors on the module. 4. Terminate individual outlet cables, one per connector, on lower 9 bridged connectors. Label cables to identify locations they run to. Use "Cabled to" area for additional cable identification.

WIRING IDENTIFICATION CHART FOR CATEGORY 5 or 5e CABLES

Instructions: Label every cable that enters the enclosure and record in the following chart. The reason to do this is that the cables are a structured part of the house and will not be moved. Components are not structured, may be changed, re-cabled, disconnected, etc. and should not be used to identify functioning of cables.

Label:	Location:	Label:	Location
V1	Family Room South Wall RG6	T18	Master Bedroom West Wall Category 5 or 5e

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8.9.1 Standard General Practices for Installers

- Always use a Structured Media Center as your main distribution point
- Do not install SMC in a fire-rated wall. Choose interi- or wall spaces
- Install your structured cabling following the star wiring or home run pattern
- Use Category 5 or 5e cable as your baseline choice for voice and data and RG-6 quad shield coax cable for TV and video
- Install 16/2 or 14/2 Speaker cable with a CL2 or CL3 rating
- Use tools made specifically for low-voltage structured cable installation
- Use mud rings at all termination locations rather than standard electrical boxes when permitted by code.
- Observe the maximum distance rule that limits a Category 5 or 5e run from the SMC to a wallplate to 90 meters or approximately 295 conductor feet
- Inspect your runs as you install them

8.9.2 Wire and Cable Installation

- Low-voltage wiring is not as damage resistant as romex so be sure to handle it carefully
- Drill independent 1-inch holes 1 1/4" from edge of framing members to run your cable
- Use nail plates to protect the cable
- Never run low voltage cable in the same drill holes as AC wiring
- Avoid damage to twisted pairs by using less than 25 pounds of pull force, by only going around one bend at a time, and by using a Leviton Cable Joe™ when routing multiple cables around corners.
- Make sure the bend radius when pulling is 20x the cable diameter or 6-7 inches for RG-6 quad shield and optical fiber cable
- Always use proper cable support, such as J-hooks and Velcro“ straps, never with standard staples
- Secure large bundles of cable loosely with Velcro™ straps such as Leviton SoftCinch, secure smaller bundles with tie-wraps
- Aim for sweeping bends in your installations rather than sharp turns that can damage the cable; the minimum bend radius for Category 5 or 5e cable is about 1 inch, for RG-6 quad shield cable about 3 inches.
- Run your low-voltage cable away from AC cable by using a separate stud space whenever possible; otherwise, maintain at least an 8 inch distance (more is better) when running parallel to AC and if you must cross it, do so at a 90 degree angle
- When running your cable in conduit, leave a pull cord to facilitate new wiring (do not exceed a 40% fill rate)
- Install your cables inside inner wall spaces to avoid outer wall insulation and firebreaks
- Keep your cable away from sources of heat such as hot water pipes and heat ducts
- Avoid running external wires; if you must, install them in conduit

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Aspects of the Pre Wire Installation

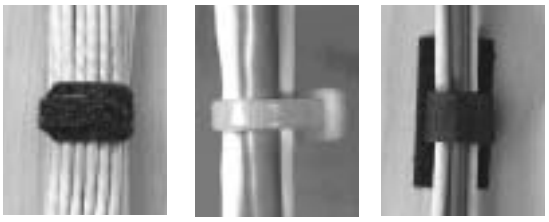
SMC 280

Use j-hooks or similar devices designed to support cables.

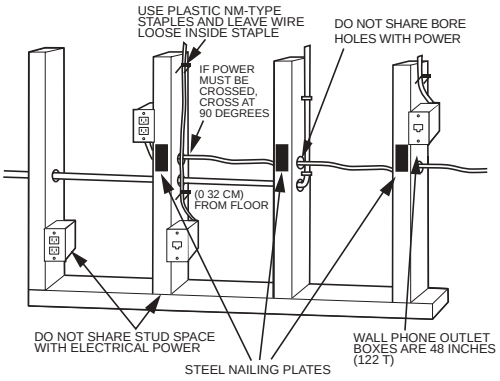
Staples by hand, or use staplers with depth stops.

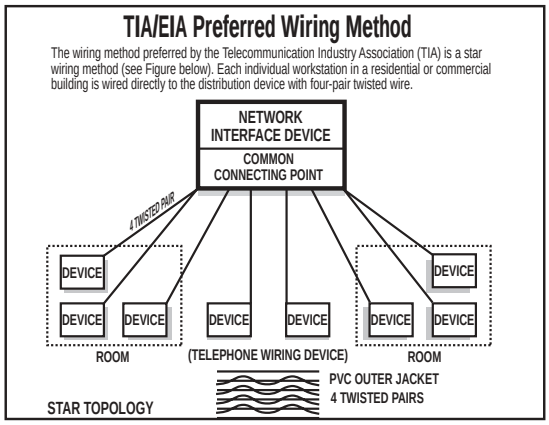
Use Velcro® to keep cables from becoming over-cinched.

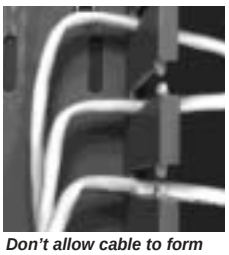
Use tie wraps loosely on large bundles. (See 'Using Tie-wraps')



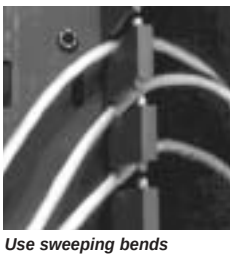
Use Velcro® tie wraps and cable straps to secure large bundles.







Don't allow cable to form right angles or sharp bends



Use sweeping bends

8

PRE-WIRE
Installation, Labeling and Documentation
Pre-Wire Installation

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TRIM OUT

9 Installation Trim Out

At this point, you have familiarized yourself with the SMC or distribution center and the routing and installation of the low-voltage cable itself. This section will deal with the distribution modules, end point devices, connectors, jacks, and other components of structured cabling.

9.1 QuickPort Jacks, Connectors, and Wallplates

The foundation of the Leviton's Integrated Networks installation is its distribution centers and the cable itself, but the system is just as dependent on its smaller hardware components. These include:

- *QuickPort Snap-In Modules and Jacks*
- *QuickPort Wallplates*

Cable terminations at connectors, modules, and Category 5 or 5e jacks are critical to the integrity of your structured cable installation. The next four sections describe terminations at wallplates.

Category 5 or 5e Cable Primer

Category 5 or 5e cable are 4-pair, 100 MHz rated unshielded twisted pair (UTP) cable that meet the EIA/TIA-568-A standard. Each twisted pair is color-coded to correspond with the color coding on the termination jack and the distribution module. In a given cable, each pair will have a twisting at a different twist rate than the other pairs in the cable or bundle. The different twist rate gives the cable greater immunity from interference that could result in distortion. For a superior installation, always untwist the least amount of cable necessary to make a connection.

Each twisted pair must attach to its own color-coded location on the eight positions of a Category 5 or 5e jack. Standard 4-pair UTP color coding uses five colors in a distinctive combination. The color combination identifies the pair number (1 through 4) as well as the first or tip wire and the ring wire within the pair.

The following is the wiring color code for Category 5 or 5e cable:

Wire Pair # and Lead Functions	Color Code
1 Tip 1 Ring	White - Blue Blue
2 Tip 2 Ring	White - Orange Orange
3 Tip 3 Ring	White - Green Green
4 Tip 4 Ring	White - Brown Brown

Low voltage cable is typically 24 gauge. It must be handled carefully in order for it to carry a signal with the least amount of loss or distortion. The installer should use the tools and methods recommended in this manual in order to maintain the integrity of the system and keep callbacks to a minimum.

Category 6 cable and termination components are still in development.

9.1.1 Terminating Category 5 or 5e Jacks

What You'll Need:

- UTP Stripping Tool
- D814 Wire Punchdown/Termination Tool
- Leviton Coaster with Jack Holder

All voice and data Category 5 or 5e cable are terminated in a Category 5 or 5e jack with 110 IDC connectors using the 568A wiring pattern. EIA/TIA-570 recommends the use of 8-conductor Category 5 or 5e compliant jacks only. To terminate a cable at a Category 5 or 5e jack:

- Allow a 24 inch service loop at the wallplate
- The jacket must touch the jack when cabling. Normally 2-1/2 to 3 inches of cable jacket is removed when cabling a jacket

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Installation for Category 5 or 5e jacks

Strip 2" of cable jacket and position first pair, white-blue/blue. The center channel lets you preserve wire twisting to less than .5" from the termination point.

Set 110-tool to low impact setting and turn cutting edge outward to terminate first pair. The patented 'cuttting ledge' trims the wire as you terminate, saving you a step.

As with the first pair, position and terminate each subsequent pair one at a time until termination is complete.

Snap strain relief caps.The connector is now ready to be snapped into any QuickPort housing or wallplate

- Use a Leviton *UTP Stripping Tool* or equivalent to strip the jacket
- Follow the color code, matching up like colored wires to their counterparts locations on the jack. Use ONLY the T568A wiring pattern, as shown on the lower portion of the jack label, when wiring the jack.
- Untwist each cable pair a *maximum* of 1/2 of an inch from the termination point
- Use a Leviton D814 Wire Punchdown/Termination Tool or equivalent for inserting the cable into the jack and trimming off the ends, one pair at a time, starting at the rear of the jacks with the blue pair.

Installer's Tip: Leviton's plastic coaster for holding jacks punchdown provides a flat, level surface for punching down cable and cutting off the ends on the jacks. The coaster fits in your pocket and is readily available when you don't have a convenient work surface.

9.1.2 Terminating Coax Connectors

What You'll Need:

- RG-6 Quad Shield Compression or Crimp Connectors
- RG-6 Quad Shield Stripping Tool
- RG-6 Quad Shield Compression or Crimping Tool depending on type of connectors. Leviton recommends Compression connectors and tool.

- Cut the cable to allow for adequate service loop (24 inches at wallplate locations. Use the RG6 quad shield cable stripper, properly adjusted, to strip off the correct amount of cable sheath, shields, and foam insulation. The exposed wire core should be about 3/8-inch in length. The exposed shield should be 1/4-inch in length

- Fold the outside braided shield evenly back along the cable sheath, and insert the connector onto the cable end
- For compression fit connectors, make sure the foam core seats flush against the inside end of the connector.You can see the foam core position by looking in the threaded end of the connector. Place the connector and cable into the compression tool, and actuate the tool to install the connector onto the cable. Check to make sure the center conductor is straight and extends 1/8-inch beyond the threaded end of the connector
- For crimp style connectors, make sure the foam core seats flush against the inside end of the connector. You can see the foam core position by looking in the threaded end of the connector
- Place the connector into the crimp tool at the proper position according to tool instructions, and crimp the connector onto the cable
- Check to make sure the center conductor is straight and extends 1/8-inch beyond the threaded end of the connector

Leviton recommends RG-6 quad shield coax cable for your TV and video installations. It can be terminated using the any of the following:

- *Compression F-connector*
- *Crimp-on F-Connector*
- *CaP Connector (See product management)*

9.1.3 Terminating at Other Connectors

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Low voltage cable can also be terminated at one of the following connectors:

- RCA connectors
- Speaker binding posts
- Banana jacks

9.1.4 Placing QuickPort Connectors and Jacks into QuickPort Wallplates

Leviton makes installing connectors and jacks at wallplate locations both a simple and an easy operation. To install *QuickPort Connectors* and Jacks into the *QuickPort Wallplates:*

- Match "UP" on the wallplate to "UP" marked on the jack or other device
- Seat the lower catch into the plate retention feature
- "Roll" the jack or other device into place until the latch snaps in place.

9.1.5 Labeling and Label Placement

Label the ends of your cables as you go. It's too easy to forget a cable's location and identity as the job progresses. You want the label to be easy to read, but located close to the termination point.

Installer's Tip: You can always install a second label some distance out from the termination point, say 6 inches, as a back-up. This is especially useful during rough-in work where cable ends might get damaged. Also, you may want to trim the cable during termination.

9.2 Structured Media Center Devices (SMC Trim Out)

The installation of devices in the SMC will take place after the drywall taping and painting have been completed. The various modules, *Pre-Configured Structured Cabling Panels*, and other devices are designed to fit neatly and securely inside the SMC.

9.2.1 Placing and Mounting Devices

Most devices will be installed horizontally, but the SMCs are designed to accommodate vertical installation as well. *Your choice of devices will determine how* they are mounted inside the SMC. Follow these guidelines when installing these devices:

- Install the most cable intense components at the top of the SMC
- Placement of devices should allow for easy looping of cables to avoid sharp angles and to maintain the minimum bend radii mentioned in Chapter 8.
- An *AC Power Module* will always be installed at the bottom of the SMC 280 and 420.

Your most cable intensive installation will be an SMC with Enhanced Infrastructure and multiple application modules.

9.2.2 Routing and Dressing Cable in the SMC

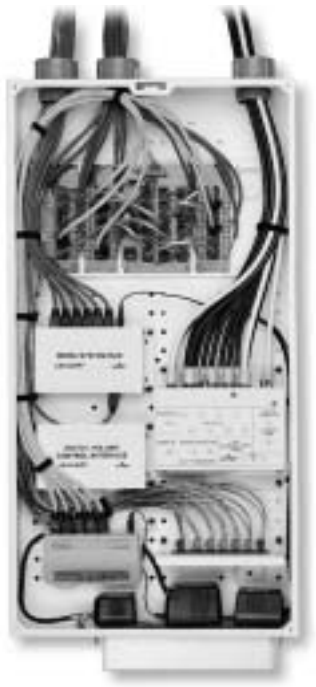
Make sure to maintain an appropriate bend radius for all cables in the SMC, per the instructions in paragraph 8.4.3

It's easier to keep track of the cables in an SMC and establish a consistent installation pattern for yourself and your employees if you follow one design. Sometimes, such as in the case of add-ons after the completion of a job, you might have to deviate from this design, but a new service offers an opportunity for a clean installation based on Leviton's recommendations.

Telephone, Data Cable and IR Cable on the Left

Using one of the knockouts on the top of the SMC, route your cables for telephones, computers, modems and infrared on the left side. If you have used color-coded cable (for instance, blue for data and gray for phone), these can be bundled according to color and pulled into the SMC. Try to keep speaker wire separated by about 8 inches.

Video Cable on the Right



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Video amplifiers and splitters should be mounted on the right side of the SMC and their RG6 quad-shield cables brought in through the right side knockout at the top. This allows for a straight drop for the cables with virtually no bend to them.

Take Note: The above cable routing patterns are recommendations. The SMC panels are quite versatile and allow for many different cable routing patterns based on installer preference and SMC customization.

Cable connections at the various modules, panels, and devices in the SMC will follow the same principles as corresponding connections at termination points at wallplates. Minimum bend requirements must be met to maintain the integrity of the cables, a minimum of cable jacket removed, and clean wire contact made with a punchdown/termination tool. Following these standard procedures will help assure you of a properly working system.

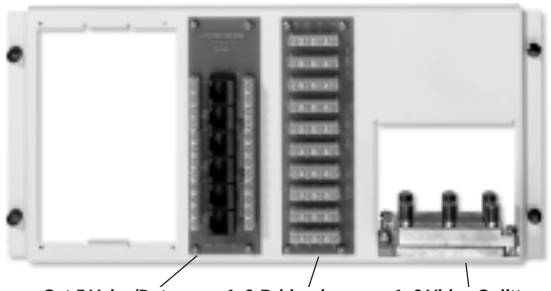
9.3 Essential Infrastructure Platform

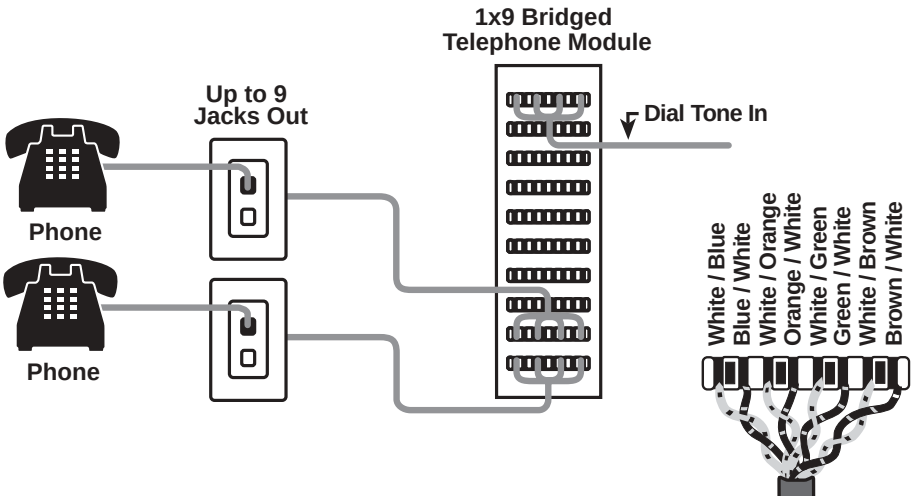
Leviton's *Essential Infrastructure* platform is the base level for residential structured cabling. It addresses standard telephone, cable TV, and data configurations. This platform uses the series *280 Structured Media Center* for Single Family homes and the series 140 for Multiple Dwelling Unit installations, plus the specific panels and devices noted below.

9.3.1 Basic Telephone Connections Using the Bridged Telephone Module

The Basic Home Networking Panel includes the *Bridged Telephone Distribution Module* consisting of ten bridged 110 D4 connectors mounted on a printed circuit board. Dial tone sources can be terminated on the first 110 connector and UTP cables routed to the SMC from the wallplate locations can be terminated on the other nine connectors. The dial tones present on the first connector will be routed to the other nine outlets in the other rooms. If there are more than nine outlets, the last 110 connector can be used as a "bridge" to jumper to the first connector of another 110 module.

Basic Home Network (BHN) Unit





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Install the twisted cable pairs following the color code on the wires and the connectors. Use a wire punch-down/termination tool to secure the ends of the wire to the connectors following the same guidelines for untwisting and stripping the cable jacket as you did with the Category 5 or 5e jacks.

Installer Tip: To gain a professional appearance on a C 4 connector, install either the orange (#2) or green (#3) wire first. This helps to center the cable. Otherwise, if the blue pair is installed first and terminated close to the cable, the brown pair will extend further than the one-half inch from the jacket and therefore be more exposed than the standard allows. Remember, the more exposure, the greater the chance for a substandard installation.

Note: *The Leviton 4X4 Breakout Module, part number 47609-4x4, is used to allow the homeowner to access all 4 lines at each jack. It is recommended that each telephone Category 5 or 5e cable is terminated to a Category 5 or 5e wall jack (568-A).*

9.3.2 Category 5 Voice and Data Module

Use the Category 5 Voice and Data Module to terminate Category 5 or 5e cable coming from your wallplate data jacks. Follow the procedure outlined above for the Bridged Telephone Module. Please see section 9.4.2 for data networking connections.

9.3.3 Coaxial Video Distribution Connections Using Passive Splitter

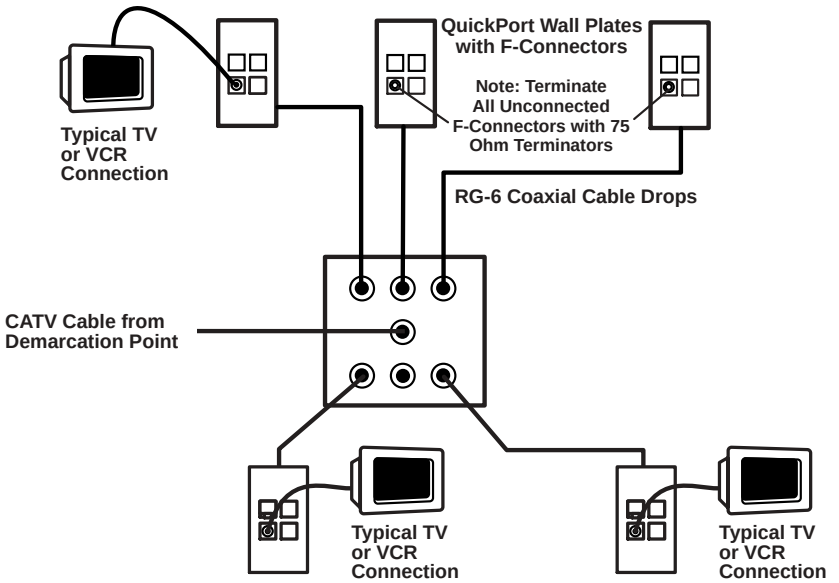
Note: *Video distribution is thoroughly covered in 9.4.3. This section is an overview for the Essential Infrastructure installations.*

Leviton manufactures three (1X4, 1X6, and 1X8) *Coaxial Cable Distribution Modules* that are used to route a single RF, such as cable TV or off-air antenna signals, to 4, 6, or 8 televisions throughout a home. The modules are installed in the SMC by lining up the mounting pins with the grid holes and pressing in the pins. They can be installed both vertically and horizontally.

To attach the recommended RG6 quad-shield coaxial cable to the splitter:

- Route your cables (they will come from wallplate locations in the house or from video sources such as an antenna or cable TV feed) into the SMC
- Connectorize the end of each coax cable with a male F-type connector (the connector must be compatible with the type of coax cable being used)
- A video *input* goes to the *center* connector of the splitter (labeled IN)
- Output cables that route the input signal to various rooms of the house are attached to any connection labeled OUT (there is no order)
- Cap any unused outputs with a 75-ohm terminator

Multi-Room Video Distribution Using 1X6 Passive Video Splitter



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9.4 Enhanced Infrastructure

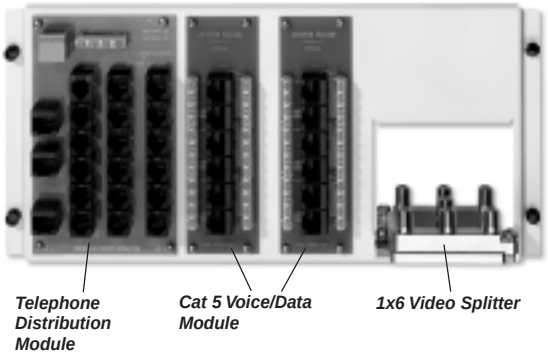
The *Enhanced Infrastructure Platform* serves networking and its multiple PCs as well as multi-room audio/video requirements. Security cameras and home theaters are also included in this platform that uses an SMC-420 as the distribution center.

9.4.1 Telephone Connections Using Telephone Distribution and Category 5 Voice and Data Modules

Leviton offers two components for superior voice and data connections in its *Enhanced Infrastructure Platform* as part of the Advanced Small Office Unit Panel:

1. *Telephone Distribution Module* that distributes up to four (4) lines throughout a home or office in combinations of Line 1 & 2, Line 3, or Line 4. This module does not stand alone, but connects to the *Category 5 Voice and Data Module* with patch cords for easy changes. The *Telephone Distribution Module* acts as the initial connecting point for incoming phone lines. It comes with two service bridge jacks that when disconnected allows isolation of the home internal wiring and serve as a test port for the entire module. The upper jack can be used to test the incoming dial tone for all incoming lines. The lower jack is connected to all of the patching jacks on the module. An expansion port is available for connecting to a second Telephone Distribution Module, thus supporting the cascading of a series of modules.

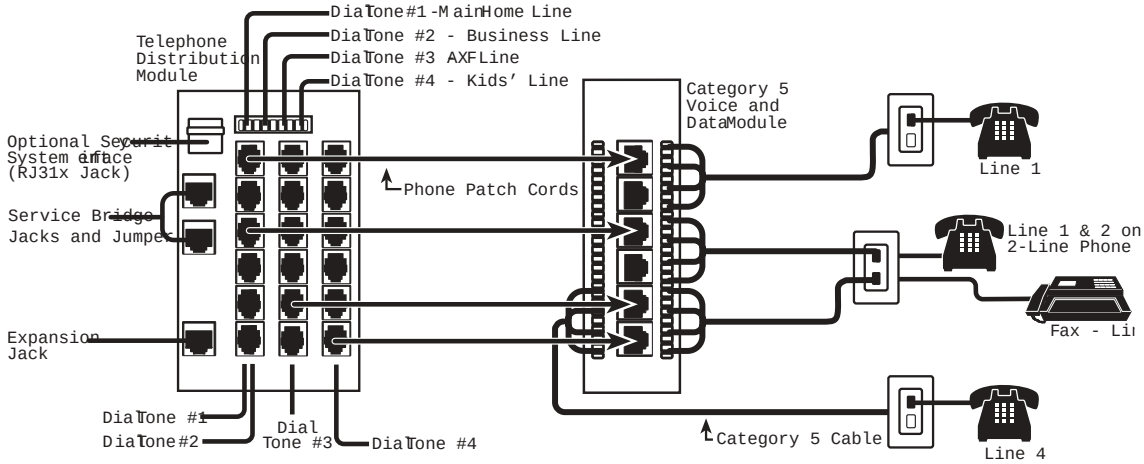
Advanced Small Office (ASO) Unit



2. *The Category 5 Voice/Data Module* is used to add modular voice/data distribution. It can be used as a stand-alone Category 5 distribution device for data, or to distribute voice over Category 5 or 5e cables to wallplate locations.

Note: Do not place any patch cord or test cable into the gray RJ31X jack as the tines in this jack can be bent out of shape. Use *only* a security system patch cord (RJ31X cord) for this connection.

It's worth repeating: To avoid removing too much of the jacket from the first (blue) or last (brown) wires, install either the orange (#2) or green (#3) wire first at the punch down block. This helps to center the cable. Otherwise, if the blue pair is installed first and terminated close to the cable, the brown pair will extend further than the one-half inch from the jacket and therefore be more exposed than the standard calls for. Remember, the more exposure, the greater the chance for a substandard installation.



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The module can accommodate six (6) Category 5 or 5e cables; each terminates on the 4-pair 110 IDC Connectors lining its sides.

To configure the connections for voice (with a Telephone Distribution Board), simply connect a 6-position, 4-conductor telephone patch cord from a port on the Telco Distribution Board to the port on the *Category 5 Voice/Data Module* that you wish to activate. The jacks on the Cat 5 module are designed to accommodate both 6-position, 4-conductor telephone cords as well as 8-position, 8-conductor cords.

9.4.2 Installing the DC Power Supply Module (Leviton 48212-DCS)

The DC Power Supply Module supplies up to 1500mA of regulated 12 VDC power for the Home Monitoring Security Cameras, the IR Targets and Emitters, and more. It should be considered as the first step in building an Enhanced Structured Media subsystem. As described previously, Leviton's DC Power Supply Module takes the place of multiple DC plug-in supplies inside the SMC. The unit comprises two pieces: an AC-DC Power Converter which plugs into the AC Power Supply Module (recommended) or a receptacle outside the SMC, and a +12VDC Regulated Power Distribution board which regulates the AC-DC Power Converter's output and distributes it to up to 12 DC-powered components inside and outside the SMC utilizing 12 wire pairs with 2.5mm DC power plugs on one end.

IMPORTANT: Do not use the DC Power Supply Module with the following:

- 10 Base-T Ethernet Hub (P/N 47605-EH)
- Or any device, which is, rated either AC power, below 12VDC, or otherwise incompatible. Otherwise, damage to the component will result.

Installing the DC Power Supply module:

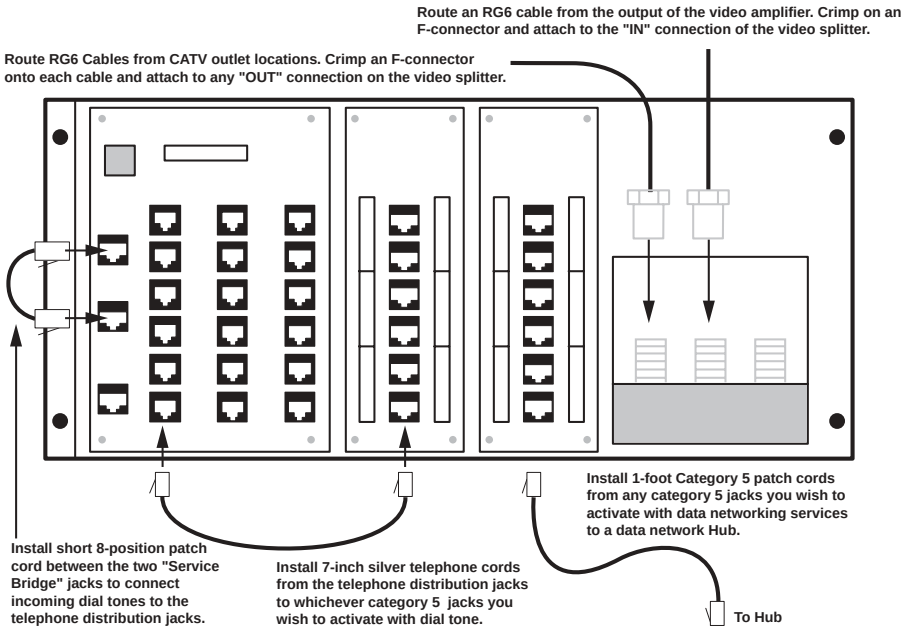
a. Do not plug the AC-DC Power Converter into the AC receptacle until the DC power supply module wiring is complete and verified to be correct!

b. Connect the plug from the AC-DC Power Converter into the jack labeled POWER INPUT, on the left side of the +12VDC Regulated Power Distribution Board.

Connecting components to the DC Power Supply module:

a. Wire types: you can run Category 5 or 5e cabling from the Power Distribution board to the various system components. But for components mounted inside the SMC use the cord sets supplied with the DC Power Supply Module. Note that while the Leviton DC Power Supply Module replaces the various DC power supplies that come with other components, you can still use the jack and connected wire by simply cutting it off and "hard-wiring" the other end to one of the DC output connectors on the Power Distribution board. This eliminates having to wire another jack to plug into the powered device, if more than 6 are required.

Instructions for Connecting Voice and Data in the Structured Media Center



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b. Run each twin power lead from DC powered components down to the Power Distribution board, assigning a separate DC output block to each. Connect the "+" side (usually striped) to POSITIVE and the "-" side (usually plain) to NEGATIVE or GROUND; when using Cat 5 wire use the BROWN pair for POSITIVE and the GREEN pair for NEGATIVE or GROUND. The components are now wired to the DC Power Supply module. Check for any potential shorts, and plug the AC-DC Power Converter into the AC Power Block or other AC outlet.

9.5 Multi-Location Networking Application

To configure the connections for *data*, identify the cable you wish to activate and connect one end of a Category 5 or 5e *patch cord* into the corresponding jack and the other end into a port of a previously installed data hub.

The 10Base-T Network Hub

The *10Base-T Network Hub* is a controller for an in-house or small office network. Patch cords connected from the hub ports to the structured wiring system connectors allow 10Base-T compatible data devices throughout the home to be networked together. These devices (such as PC's and peripherals) will need network cards or adapters and related software.

Like all Leviton modules and panels, the hub easily installs inside a SMC through the use of mounting pins. It can be mounted horizontally or vertically. Simply align the pins with the mounting holes and push them in, securing the hub to the SMC.

Note: *You must use the AC/DC power supply that comes with the Network Hub. Do not use any other AC/DC power supply with this module.*

The following illustrations show both front and rear view of the hub.

FRONT (with LED indicators)

10Base-T Network Hub

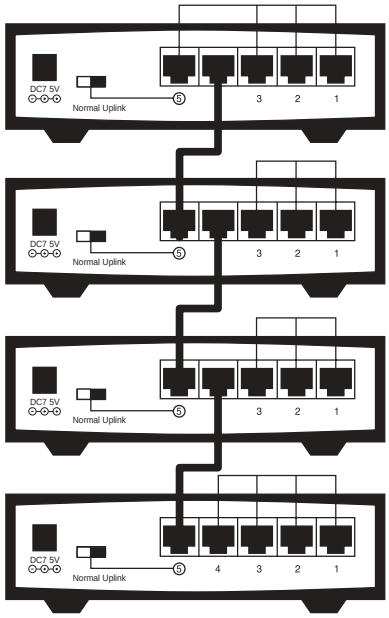
A. Power (RED) Indicator: Lights while the hub is powered up

B. Collision (YELLOW) Indicator: Blinks when the hub detects a collision on the network

C. Link/Receive (GREEN) Indicators: Show the status of the data link and remain on when the connection is OK, blinking if the data is being received on that segment

D. Partition (RED) Indicators: Show malfunctioning ports; faulty ports are automatically isolated by the hub (this partition returns to normal status when the port recovers)

REAR



E. Category 5 or 5e Ports: The hub is equipped with 5 Category 5 or 5e ports for making 10Base-T hub-to-Cat 5 Module connections

F. NORMAL/UPLINK Switch: Slide this switch to "Uplink" to enable cascading with Category 5 or 5e cords

G. AC Adapter Port: Insert the AC adapter jack into this port

The *10Base-T Network Hub* is a specification for Ethernet networks based on twisted pair cabling. The maximum conductor length of a segment for 10Base-T networks is 90 meters (approximately 295 feet).

To establish 10-Base-T connections, you will need the following equipment:

- Twisted pair Category 5 or 5e patch cords for hub-to-Cat 5 Module

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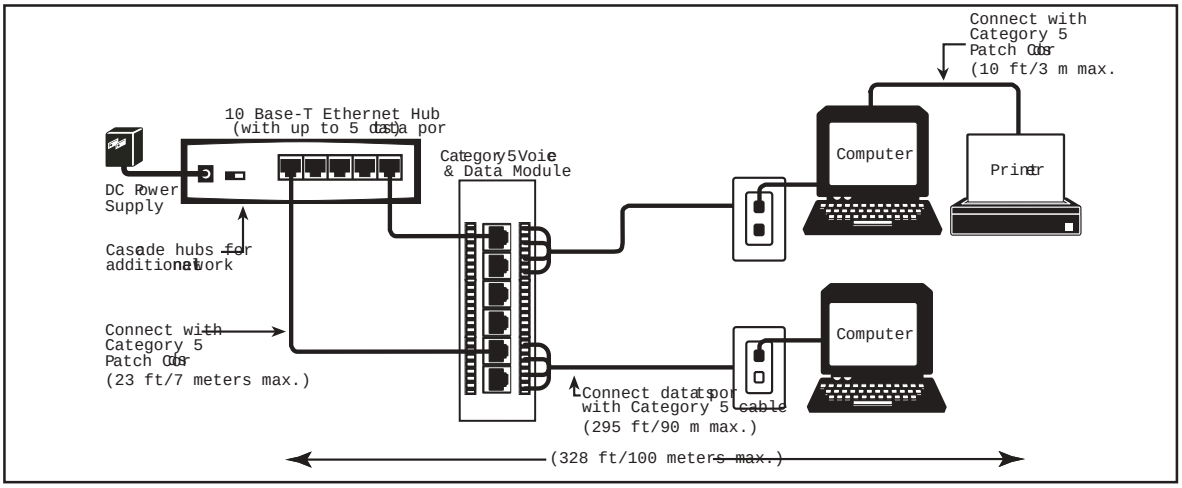


- Twisted pair Category 5 or 5e patch cord for hub-to-hub connections, usually referred to as “hub cascading”, for more than 5 ports
- Twisted pair Category 5 or 5e patch cords for wallplate Cat 5 jack to network interface card (NIC) connections at your PCs

Note: *Each PC and peripheral in the network will also require a 10Base-T compatible NIC or adapter and Windows 98 or higher (or similar operating system and associated software) to function on the network.*

The *10Base-T Network Hub* has five Category 5 or 5e connectors for attaching up to five 10Base-T based workstations. To establish such connections:

- Ensure that both the hub and the soon-to-be connected workstation are in the OFF modes
- Plug one end of the patch cord into an available 10Base-T hub port
- Plug a patch cord at the other end of the link into the workstation NIC

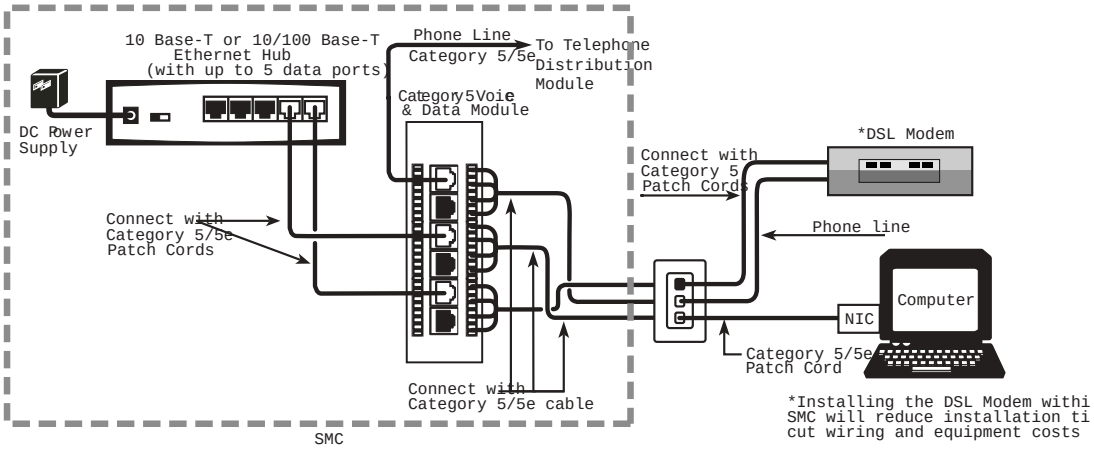
EXAMPLE

Your client will have a PC and printer in a home office and will want to access the printer from a PC in another bedroom. Wire the unit as shown in the diagram below:

- The two office outlets (the office PC and the printer) will wire to ports 1 and 3
- The bedroom outlet will wire to port 5
- Install Category 5 or 5e patch cords from ports 1, 3, and 5 to ports on a *10Base-T Network Hub*, following Leviton’s instructions for that device; the two PCs and the printer will now be networked together

Take Note: When your 10Base-T network needs to expand beyond the hub’s five available connections, you can add a second hub, cascading it with the original. This hub features a selective NORMAL/UPLINK switch that allows you to use Category 5 or 5e patch cords when cascading hubs. Be sure that the slide switch next to the fifth port is switched to the UPLINK position when cascading your hubs. A maximum of four hubs can be cascaded, allowing for a total of 14 network stations to be connected.

DSL Distribution- Modem Outside the Structured Media Center



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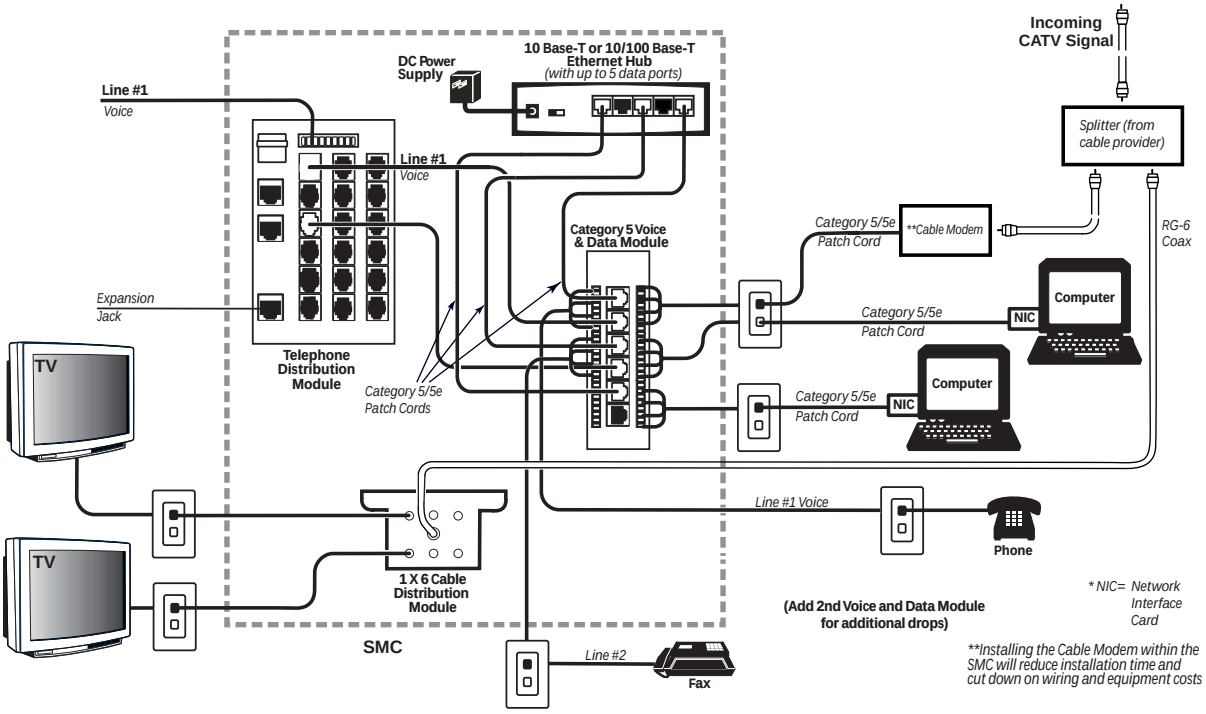
Cable Disribution- Modem Outside the Structured Media Center



The 10/100Base-T Network Hub

Sharing the same properties as the 10Base-T Network Hub, but with a faster speed of 100Mbps, the *10/100Base-T Network Hub* is a controller for an in-house or small office network. Patch cords connected from the hub ports to the structured wiring system connectors allow 10/100Base-T compatible data devices throughout the home to be networked together. These devices (such as PC's and peripherals) will need network cards or adapters and related software.

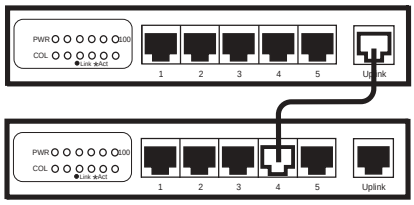
10/100Base-T Network Hub w/Adapter

Like the 10Base-T, the10/100Base-T hub easily installs inside a SMC through the use of mounting pins. It can be mounted horizontally or vertically. Simply align the pins with the mounting holes and push them in, securing the hub to the SMC.

Take Note: When your 10/100Base-T network needs to expand beyond the hub's five available connections, you can add a second hub, cascading it with the original. The hub features an UPLINK port that allows you to use Category 5 or 5e patch cords when cascading hubs.

The illustrations below show both the front and rear view of the hub.

FRONT (with LED indicators)



A. Power (GREEN) Indicator: Lights while the hub is powered up

B. Collision (AMBER) Indicator: Lights when the hub detects a collision on the network

C. Link/Active (GREEN) Indicators: Show the status of the data link and remains on when a good connection is established, and blinks if the data is being received on that segment

D. 100Base-T (GREEN) Indicators: Show the status to a link partner and the 100Mbps IDLE symbol is detected, and 'off' when port is running in 10Mbps or no link is established.

E. Cat 5/5e Ports: The hub is equipped with 5 Category 5 or 5e ports for making 10/100Base-T hub-to-Category 5 or 5e Module connections

F. UPLINK Port: Allows you to connect to a switch or cascade to a hub with Category 5 or 5e cords

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REAR

G. Power Port: Insert the 12 VDC adapter plug into this port on the 10/100 Base-T hub

The *10/100Base-T Network Hub* is a specification for Ethernet networks based on twisted pair cabling. The maximum conductor length of a segment for 10/100Base-T networks is 90 meters (approximately 295 feet).

To establish 10/100Base-T connections, you will need the following equipment:

- Twisted pair Category 5 or 5e patch cords for hub-to-Category 5 or 5e Modules
- Twisted pair Cat 5 patch cord for hub-to-hub connections, usually referred to as “hub cascading”, for more than 5 ports
- Twisted pair Category 5 or 5e patch cords for wallplate Category 5 or 5e jacks to network interface card (NIC) connections at your PCs

Note: *Each PC and peripheral in the network will also require a 10/100Base-T compatible NIC or adapter and appropriate driver with associated software to function on the network.*

The *10/100Base-T Network Hub* has five Category 5 or 5e connectors for attaching up to five 10/100Base-T based workstations. To establish such connections:

- Ensure that both the hub and the soon-to-be connected workstation are in the OFF modes
- Plug one end of the patch cord into an available 10/100Base-T hub port
- Plug a patch cord at the other end of the link into the workstation NIC

9.5.1 Video Distribution (Coaxial)

There are many possible variations of coaxial video distribution using Leviton Structured Media Components. The three basic types used in residential work are the following:

- *Passive distribution* using a 4-, 6- or 8-way passive splitter
- *Hybrid distribution* combining the passive splitters with the dedicated *Video Amplifier*
- *Active distribution* using the *Bi-Directional Video* module or the *3x4 Multi-Switch.*

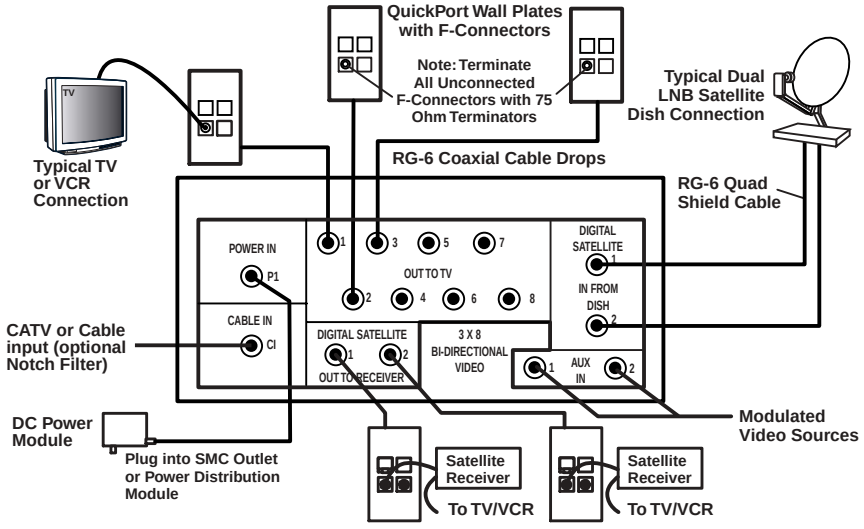
Passive Distribution with the 4-, 6- or 8-way splitter

The simplest distribution method is *passive distribution*. It is a satisfactory solution for distributing coaxial cable TV in multiple rooms in a single-family home. Leviton splitters come with 4, 6, or 8 outputs to correspond to the number of video locations covered by your installation. The 6-way splitter, which is included with the *Essential Platform*, is designed to meet the majority of video distribution needs, for example:

- Two seperate wallplate locations in the living room.
- One location in the kitchen
- One location in each of the three bedrooms

A separate stand-alone 6-way splitter is also available.

Multi-Room Video Distribution Using
3x8 Bi-Directional Video Distribution Module



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To install a stand-alone splitter:

- Line up the module's pins with the grid holes on the back of the SMC (the module can be mounted horizontally or vertically)
- When set in the desired location, push the pin plungers to secure the module to the SMC
- Route your RG6 quad-shield coaxial cable into the SMC, avoiding sharp or abrupt bends in the cable; install a male F-type connector at the end of each cable
- A video input (from your cable TV or antenna, for example) goes into the *center* connector (marked IN) on the splitter
- Attach your cables, those going to each video location, to the connectors on the splitter marked OUT
- Cap any unused outputs with a 75-ohm terminator

Installer's Tip: If you have run extra RG-6 cable through the home, it is a good idea to spec in enough splitter capacity and coax to handle an additional two television locations more than the actual number of terminations required, in order to allow for future expansion. If doing so, follow the same rule on any video splitter and cap all unused F-connectors with Leviton 75-ohm terminators. An uncapped connector can provide an "open" video circuit that can cause extra noise to plague the system that can then show up as ghosting on all the TV screens to the house.

Hybrid Video Distribution

The typical cable TV signal coming into a home is usually sufficient to provide a clear picture to the end device, such as a television or VCR. In some cases, the signal might need amplification. There are three things that affect the signal level in the home:

- The level of the signal from the CATV provider at the demarcation point
- The number of coax runs (from the splitter, or number of splits)
- the length of the coaxial cable runs

This is especially likely if the TV sets furthest from the cable entrance to the home exhibit visible problems such as "snow". Leviton's Video Amplifier is ideal for correcting this situation and easy to test by simply inserting the device into the coaxial video system.

Installer's Tip: Please read Service Provider Coordination in Chapter 4 and check with your CATV provider to determine the signal level at the house demarcation point. The input signal level from the CATV provider or local antenna will be between 0dBmv and 15dBmv. The lower end of that range will require a video amplifier. At the high end of the range, you might have sufficient signal to make a video amplifier unnecessary for up to eight video terminations. Beyond eight video terminations, you will probably need a video amplifier.

Active Distribution with the 3x8 Bi-Directional Video Module

For more sophisticated video distribution subsystems–those involving a combination of cable TV, satellite TV and security video, for example–Leviton's *3x8 Bi-Directional Video Module* is the solution. This module features an internal 20dB bi-directional amplifier on the CATV input plus 2 auxiliary inputs, all routed to an 8-way splitter. The *3x8 Bi-Directional Video Module* is compatable with the advanced, two-way signaling video technology and saves the installer the trouble of installing a separate video amplifier and three video splitters to accomplish the same job and does so at a cost-effective price.

Take note: The 3x8 Bi-Directional Video Module uses a dedicated power supply that connects to an F-connectorized power cord. You should not attempt to substitute any other cable.

To install the 3x8 Bi-Directional Video Module:

- Align the unit with the mounting holes in the back panel of the SMC
- Push the pin plungers in, to secure the module
- The internal 8-way splitter outputs connect to as many as 8 room locations; an essentially unity gain design uses pre-set amplification so no adjustment is necessary on the part of the installer
- A map on the front face of the module describes each output; the cable marked CABLE IN (CI) connects to an incoming cable TV or antenna signal
- Two Auxiliary Inputs (AUX 1&2) connect to the modulated security cameras and other modulated sorces such as DVD player
- Two satellite inputs (DIGITAL SATELLITE IN FROM DISH 1&2) are connected to two digital satellite OUT TO RECEIVER connectors (1&2) that route the input from up to two satellite dishes (or single dish with two LNB's) to two satellite receivers located at any wallplate location
- Cap any unused OUT TO TV or AUX IN connections with 75-ohm termination caps

Active Distribution with the 3x4 Multi-Switch Module

The *3x4 Multi-Switch* is a satellite signal distribution module which routes incoming satellite signals to dual LNB (Low Noise Block Converters) Digital Satellite Systems to up to four satellite receivers to rooms throughout the home.

The receivers automatically determine which signals and which LNB is appropriate according to the receiver voltage. This module also incorporates a separate

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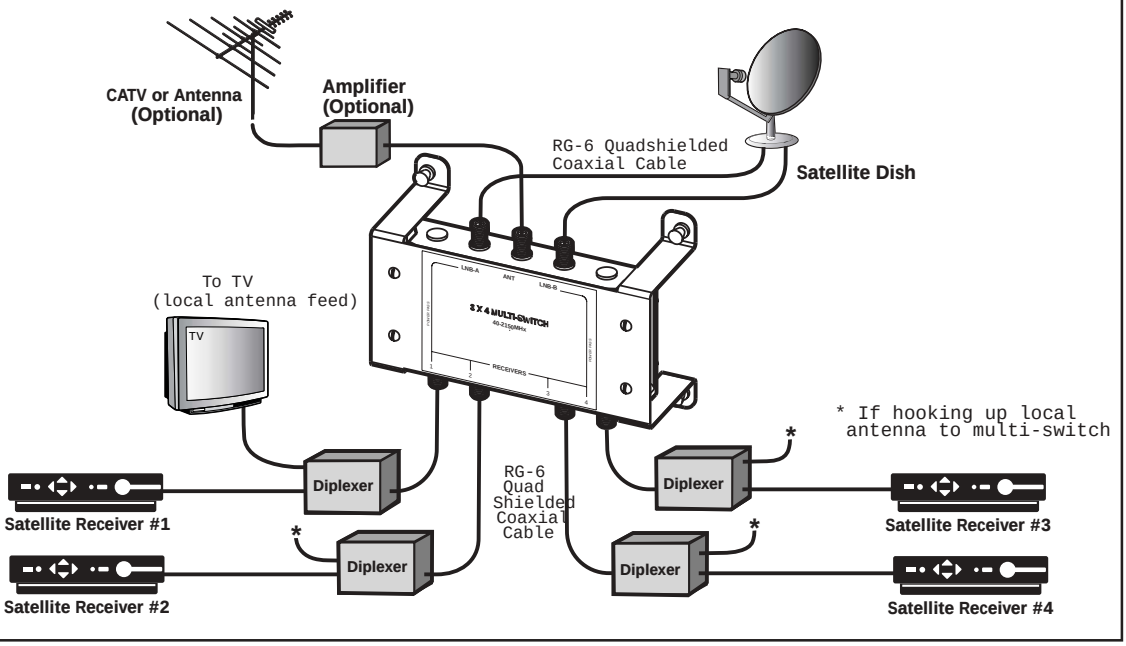
Satellite Signal Distribution Using 3x4 Multi-Switch



input to receive TV antenna signals, which is best used in combination with a video amplifier.

To install the 3x4 Multi-Switch module in the SMC:

- Align the mounting pin plungers with the mounting holes in the back panel of the SMC (the module must be mounted horizontally)
- With the mounting pin plungers in the "out" position, press the unit into the grid in the desired location
- Final setting is made by pushing the plunger head in to lock it in place
- Attach the satellite cable (RG-6 "F" type) connector to either of the LNB input ports (marked "LNB-A" or "LNB-B")
- Attach the RG-6 "F" connector from the TV (terrestrial or CATV) antenna to the input port (marked "ANT")

Take Note: When using the 3x4 Multi-Switch in combination with a TV antenna, a video amplifier is recommended to boost the outgoing signal.

- Attach the RG-6 "F" connectors from the satellite receivers (in up to four room locations) to the output ports (marked "Receivers, 1-4") on the Multi-Switch
- Cap any unused input or output connections with 75-ohm termination caps

Take Note: When combining the incoming TV antenna signal with the incoming satellite signal, it is necessary to use a diplexer to separate out signals before connecting the the satellite receivers.

9.6 Multi-Room Stereo Sound Application

In the Leviton *Structured Media* concept, multi-room distributed stereo is also centralized in the *Structured Media Center* for manageability and reliability. Three pair of speaker wires (left and right) and 12VDC power need to be run from the stereo system or entertainment center to the SMC; the *Audio Bridging Module* will distribute this stereo signal to up to 6 locations or "zones."

Take Note: Many audio/video receivers with built-in surround have up to 5 speaker channels. While any full-featured model will have a provision for connection to an auxiliary, stereo-only speaker pair, it is important to locate and use *only* the amplifier outputs dedicated to powering remote speakers. This might also require activating the A/V receiver's "multi-room/multi-source" switching functions. Consult the Owners' Manual supplied with the A/V receiver for complete information.

9.6.1 Multi-Room Considerations

Leviton's *Audio Bridging Module and Volume Controls* provide up to 6 parallel speaker left/right pair connections from a single stereo pair left/right input. Before connecting six pairs of speakers, you'll need to know the *impedance* ratings or levels of the speakers you're working with.

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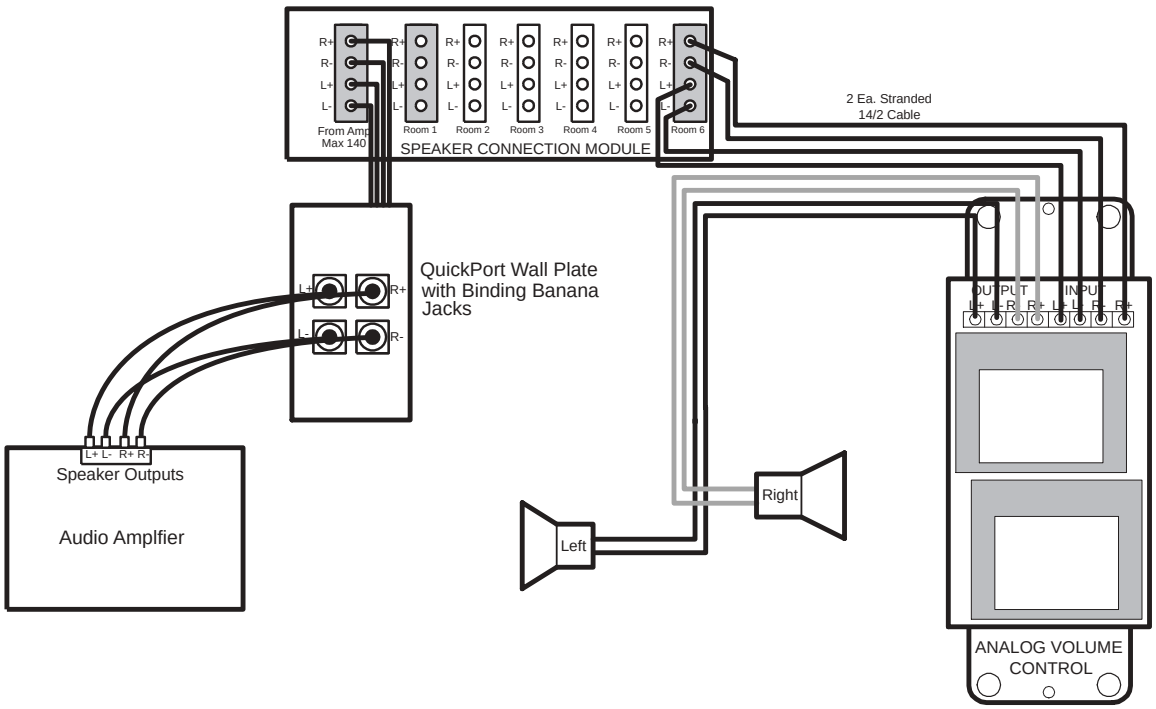
Multi-Room Stereo - Analog Volume Controls and Audio Bridging Module



Audio System Impedance

All loudspeakers have an impedance rating measured in Ohms. The typical impedance rating for speakers is between 4 and 8 Ohms. Amplifiers also have an *output impedance rating*, usually no lower than 4 Ohms and no higher than 16 Ohms. This means the total speaker "load" must be no lower than 4 ohms and no higher than 16 ohms. When speakers are connected in parallel (the "+" terminals are connected to the "+" terminal of the next speaker, the terminals are connected similarly to each other, and then again similarly to the amplifier), their impedance is cut in half. Two 8 Ohm speakers become a single 4 Ohm load.

Because a stereo amplifier is really two separate monaural amplifiers comprising left and right channels, the principle applies with speakers in pairs—two left 8 Ohm speakers become a 4 Ohm load on the left amplifier channel, and two right 8 Ohm speakers become a 4 Ohm load on the right amplifier channel.

Take Note: One exception to the normal 4-16 Ohm impedance rating for an amplifier is a public address ("PA") type amplifier used in paging and background music systems. These use transformers to overcome impedance-matching problems, but audio transformer designs are rarely encountered in home audio systems.

As a result, if you are connecting anything more than 2 speaker pairs you must take steps to keep the impedance between 4-16 Ohms. Running anything below 4 ohms or above 16 ohms can cause amplifier damage.

To avoid amplifier damage when connecting between 3 and 6 pairs of speakers, do one of the following:

- Insert an impedance-matching device such as an impedance matched volume control (P/N 40901-D*) between each speaker pair and the *Audio Bridging Module*
- Insert a separate impedance-matching audio component between all speaker pairs and the *Audio Bridging Module*, usually as a "loop" back to the entertainment center or A/V receiver

This manual only covers the first of these two options. The second option will depend on the design and connection of the numerous devices on the market.

Connecting the Audio Bridging Module

Just as when you're working with AC circuits, it's important to shut down your power source before working on low-voltage wiring. In the case of connecting to the *Audio Bridging Module*, you must shut down the audio system amplifier before making any connections.

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To connect to the *Audio Bridging Module:*

- Using QuickPort snap-in modules with speaker binding posts, run a minimum of 16/2 CL-2 rated cable from the auxiliary LEFT and RIGHT speaker outputs of the entertainment center or A/V receiver.
- Confirm that the polarity or consistency exists between the "+" (sometimes marked POSITIVE or colored RED) and "-" connections (sometimes marked NEGATIVE or GROUND, or colored BLACK). Paired speaker wire will always be marked for easy identification by a distinctive color, stripe, lettering or ribbing on one wire. It is important that the "+" and "-" terminals on the *Audio Bridging Module's* FROM AMP connection correspond to the same terminals on the amplifier.
- Remove approximately one quarter-inch of insulation from each stranded speaker wire and twist the strands of each wire together.
- Identify the 4 terminals on the FROM AMP terminal block (R +, R -, L +, L -). Loosen each set screw on the side of the FROM AMP terminal block, insert the bare end of the wire into the corresponding top hole right up to the insulation jacket, and re-tighten the screw. This will clamp down on the wire and ensure a good contact
- Repeat this step for the other 3 terminals. *Check to make sure that no wire strands are loose or exposed as this could create an amplifier-damaging short circuit.* Repeat the process for each connected speaker pair using the ROOM 1-ROOM 6 connecting blocks.
- Observe polarity throughout the connection process

Take Note: Each block on the *Audio Bridging Module* is removable for easier wiring. Simply slide-off the blocks, make all the connections, and replace on the module

9.6.2 Installing and Connecting Analog Volume Controls

Each room or area can have its own volume control. To install a volume control:

- Prepare the speaker wire by stripping 3/16-1/4" of insulation and twisting the strands together tightly.
- Connect the wires coming from the SMC's Room # block to the four INPUT terminals on the back of the volume control by loosening the set screws and inserting the stripped, twisted end of the wire. Be sure to connect the wires so that the correct channel and polarity are observed (R+ to R+, R- to R-, L+ to L+, L- to L-). Check for loose braids to avoid short-circuits.
- Next, strip and twist the ends of the speaker wires and connect them to the four OUTPUT terminals on the back of the volume control. Be sure to connect the wires so that the correct channel and polarity are observed (R+ to R+, R- to R-, L+ to L+, L- to L-).
- Check all connections for loose strands, and check connection integrity as there can be considerable pressure exerted on these connections by the relatively stiff and thick speaker wire when the wired volume control is stuffed back into the mud ring bracket. Once all *Audio Bridging Module* connections, volume control connections and speaker connections are complete, turn the system ON with the volume turned all the way down and slowly raise it to test performance. Leviton volume controls have a preset metal tab under the knob that can be used to set a limit on how high the volume can be turned. To change it, remove the knob, loosen the shaft nut, then reposition the tab. Tighten the nut and replace the knob. This tab is also used to set the minimum impedance to match the output of the homeowners audio amplifier. Check with Leviton Applications Engineering if you are installing more than one set of speakers on each volume control.

9.6.3 Setting Impedance for the Leviton Impedance Matching Volume Control

Since most consumer amplifiers are designed to run only 1 pair of speakers, a balancing system is required to allow a greater number of speakers to be installed. The Leviton impedance matching volume control serves this purpose by allowing the installer to adjust the overall system impedance to match the amplifier. When setting the impedance at a volume control, it is important to know how many other volume controls are connected to the same amplifier. It is this number of speakers or volume controls that dictates the setting of each volume control. For example:

One amplifier is to power six volume controls that each control one pair of speakers. The total number of speakers for this system is 6 pair, so EACH volume control must be set to X8 or 9 "clicks" to balance the load on the amplifier.

The impedance matching feature is activated by the small metal tab below the volume control knob (visible when the knob is removed from the shaft). The volume control normally operates from position 1 (far counterclockwise) to position 10 (far clockwise). The control is shipped with the factory default setting as position 10 ("click" number 10) based on left-right adjustment. Because of the tab's position, the volume control in the factory default position cannot exceed position 10—that means it is already preset for four 8-Ohm or two 4-Ohm speakers per channel.

If you need to change the matching impedance in the volume control, use the following steps:

1. Remove the control knob

2. Loosen the large nut over the threaded shaft

3. Rotate the tab all the way counterclockwise

4. With the nut still loose, put the knob back on to engage the tab at the full counterclockwise position and rotate the knob clockwise to the number of clicks indicated in the chart on the following page

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5. Remove the knob

6. Tighten the nut without moving the tab

7. Replace the knob. The tab position will prevent the knob from turning to the point where the impedance toward the amplifier becomes too low.

Note that there are two more settings available: position 11, which is for two 8-Ohm speakers per channel, and position 12 which is fully ON and should be used only for one 8-Ohm speaker per channel. The following chart will help you properly position the impedance matching metal tab. Double check the setting on the volume controls by counting the "clicks" from left to right.

Number of 4-Ohm speakers/channel	*Number of 8-Ohm speakers/channel*	*Number of steps (clicks) to use on volume control (upper limit)*
-	2	11
-	3	10
2	4	10
-	5	9
3	6	9
-	7	9
4	8	9

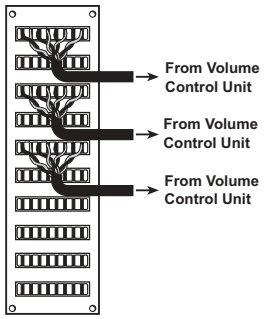
9.6.4 Installing the Decora Digital Volume Controls

The connection from the Wall Mount Decora Volume Control to the Volume Control Hub is made with a single Category 5 or 5e wire using all 8 conductors, usually run inside a wall. Only digital control signals, and not stereo signals are routed to the Volume Control Unit.

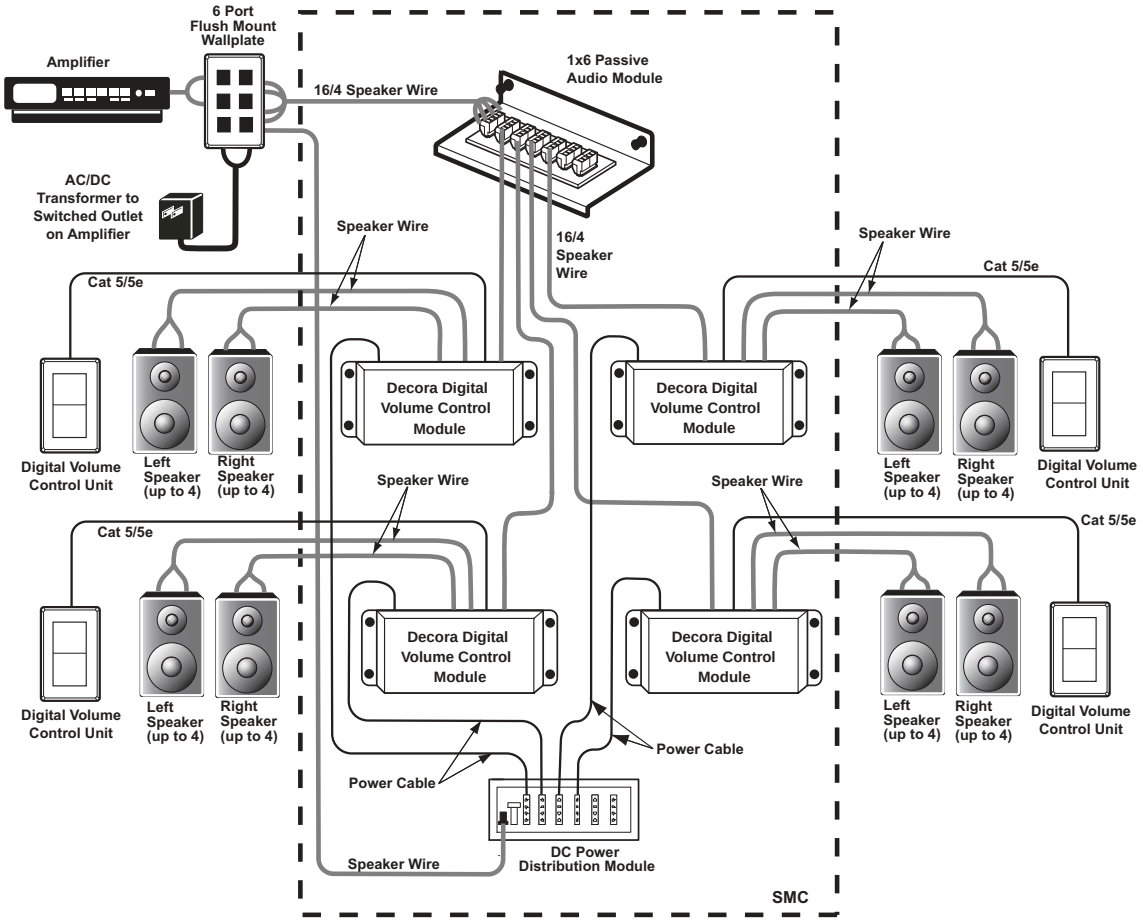
Take Note: If more than one Volume Control Unit is to be connected to a Hub (where multiple units will be controlling the same speakers) the 8-wire connections to the Volume Control Units must be parallel.

To install the Volume Control Unit:

- The unit may be mounted in any single-gang, low-voltage mounting ring, or an electrical box that is deep enough to accomodate the device and associated wiring.



Digital Volume Control Used In 4-Zone Audio Distribution



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Take Note: Electrical boxes containing more than 110VAC or higher must be equipped with an approved barrier that separates high and low voltage sections.

- Crimp an 8-pin modular plug onto the Category 5/5e cable following T568A practices and plug it into the Volume Control Wall Unit.
- Finish the installation with a Decora Wallplate (provided).

To connect the Hub to stereo equipment use fire-rated 14-18 gauge wire for the speakers. Connect the stereo amplifier or receiver outputs (left and right) to the Hub connector (labeled "TO AMP"). The Hub has independent floating grounds for safe use with bridged amplifiers. The Hub is rated for 120 watts per channel (max.) Four-ohm amplifiers can power up to 8 Hubs. Eight-ohm rated amplifiers or receivers can power up to 4 Hubs. To connect:

- Wire the amplifier speaker terminals parallel to the Hub's "TO AMP" terminals.
- Wire the Hub connectors labeled "SPEAKER" directly to the speaker in the controlled room, strictly observing polarity. Use either the amplifier's Speaker A or Speaker B outputs, but not both.

9.6.5 Preparing the Speakers for Mounting

Leviton *Structured Media Speakers* may be painted to match room décor. To paint the speakers:

- Remove the grille and remove the insulating pad attached to its back
- Use the painting template provided to paint the visible part of the speaker frame
- After the paint has dried, remove the template
- Anti-rust aerosol paint is recommended for the grille.

9.6.6 Installing the Speakers

To install Leviton speakers:

- Position the mounting template between the studs (use the wire location as a guide) and trace the inside of the template with a pencil; use a carpenter's level to ensure accuracy and evenness
- Repeat for the other speaker locations and check that they are even with the first speaker
- Drill a 1" hole directly in the center of the traced area, avoiding contacting the speaker wire or anything else in the wall
- Use a drywall saw or jigsaw to cutout the traced center area
- Grasp the cut drywall using the 1" center hole, and carefully pull it out taking care not to rip the drywall.
- Remove the speaker grille using a very small screwdriver (careful—grilles are easily bent)
- Hold the speaker up to the hole and check the fit
- Strip 1/2 inch of insulation from the ends of the speaker wires and twist the strands together tightly
- Connect the stripped speaker wire to the corresponding terminals on the back of the speaker (RED for +, BLACK for -) and tighten the terminals
- Position the speaker into the opening with the brackets behind the drywall and evenly tighten the screws until the speaker is secure with the drywall
- Place the supplied rubber strips on the inner portion of the speaker frame and insert the grille; the strips ensure a tight fit and eliminate vibration problems

Installers Tip: Reversing polarity, or connecting a "+" on the amplifier to a "-"on the speaker, will not cause any damage. It will result in a very weak or thin bass sound and somewhat echoey or vague vocals. If you hear substandard sound from any installed speaker pair, *shut the system off* and simply reverse the connections to the back of one speaker only in that room. If the problem goes away, you have reversed polarity somewhere in the wiring. Make sure you check the connections right back to the amplifier because the other speaker pairs in the system may still be incorrect.

Installers Tip: With ceiling-mounted speakers, occasionally a rattling sound might be heard when the system is first operating. With correctly mounted speakers, the problem is usually caused by pieces of wire insulation and other debris that have fallen onto the back of the large speaker cone (woofer). If removal is difficult, turn the system ON, turn the other volume controls all the way DOWN and run several seconds of inter-station noise (white noise) with the BASS control turned UP in the affected room. This will bounce any remaining installation debris off of the cone's back surface.

9.7 Multi-Room Audio/Video Options

Leviton's Decora Media System (DMS) utilizes advanced electronics and Category 5 or 5e cable to distribute audio and video signals throughout a house. Signals from a VCR, DVD, A/V Center, or even a PC/MP3 Player, or PC can be sent through up to 1000 feet of Category 5 or 5e cable with no discernable distortion. The DMS is composed of three components:

- A send unit (P/N 48210-MSU) for transmitting signals at the source
- A receive unit (P/N 48210-MRU) for receiving signals
- A Media Hub (P/N 48210-MCH) for whole house distribution to up to six receive units

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Decora Media Hub

Stereo Modulator

Several topologies are possible within the DMS including:

- An audio/video networking scheme, with A/V or PC components sending and receiving audio/video signals via a single send and multiple receive units and the centralized hub
- A hub-to-receive model where information is sent from the hub to remote receive units
- A point-to-point model where the send and receive units are linked directly together

The DMS has the following features:

- "Daisy chain" feature for hubs: distribute audio/video signals to over 20 locations
- Composite (baseband) RCA inputs (L/R Audio and Video) for connectivity directly from a single audio/video source
- Send and receive units fit standard single-gang electrical boxes and LV rings
- Advanced circuitry with automatic equalization streams analog audio and video signals with less distortion
- Stereo audio input/output handles Dolby® ProLogic™ surround signals

All the components in the DMS are run on DC and can be powered either independently or through the Media Hub. *Important: This product requires a dedicated Category 5 or 5e run.*

Note: *The DMS Hub requires the 15 VDC Transformer (Supplied)*

9.7.1 Stereo Modulator

The *Stereo Modulator* (P/N 48210-DSM) is a desktop-style device designed to work with audio/video components such as DVD players. It takes the signal from an audio/video component and converts the signal to a cable TV channel that can be broadcast over the whole-house coaxial network to multiple televisions on one unused cable channel, effectively setting-up an in-home entertainment channel. The “frequency agile” modulator outputs on any UHF channel between 14 and 69 or CATV channel between 54 and 94 and 100-125 (channels 75-80 are recommended with the *Notch Filter, P/N 47689-B)*.

9.8 Multi-Room Stereo Infra-Red (IR) Control Connection

Each room wired for sound is a candidate for remote infra-red or IR control. With an IR control, your client can select individual CD’s or choose remotely between sound sources (CD or FM, for example). Connecting a remote IR control is relatively simple, as it does not entail the same current and impedance considerations as do multi-room speakers and volume controls.

Think of *Multi-room IR* as an extended remote control. The remote control’s IR signals are received by an *IR Room Target* (P/N 47621-MIE) mounted in a centrally-accessible location within a room. Each *Room Target* converts IR commands from a remote control into electrical impulses. At the other end (the audio/video components to be controlled), an *IR Emitter Bug (P/N 47621-CMS)* converts these electrical impulses back into IR signals that are then received by the A/V gear’s built-in remote sensor as if the remote control were in the same room. The *1x9 Bridging Module* (connects multiple emitters to multiple IR targets. Targets are located in remote rooms from which the user will want to control the system. The IR Targets link back to the Bridging module, from which the command signals are routed back to the audio/video component emitters also over Category 5 or 5e cable.

9.8.1 Installing Targets and Emitters

IR Targets can be installed in celings or walls where they will not be blocked by furniture. Connect the targets to Category 5 or 5e cable (previously installed and left hanging through a small 1/2" diameter hole in the drywall). Use the small wire nuts supplied with the target to connect the red wire to the brown pair, the black wire to the green pair, and the yellow wire to the orange pair of the Category 5 or 5e cable. Once all connections are secure, carefully work the target firmly into the drywall hole.

At the Audio/Video (Home Entertainment) Center

Audio/video (A/V) components come with built-in remote sensors that work in conjunction with remote controls. To find this sensor:

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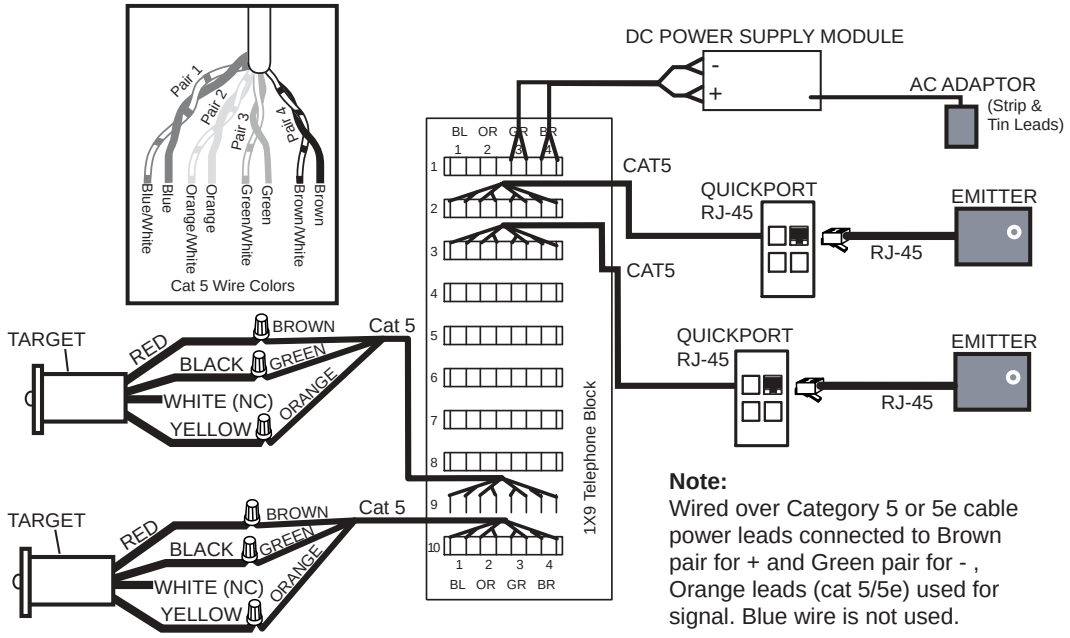
Multiple Targets & Emitters Using Bridge



Note:
Wired over Category 5 or 5e cable power leads connected to Brown pair for + and Green pair for - , Orange leads (cat 5/5e) used for signal. Blue wire is not used.

- Shine a flashlight on the front panel of the component
- On A/V receivers, DVD players, and VCRs, the sensor is usually (but not always) in the tinted window near the LCD display that indicates the time and other functions
- It may also be marked “Remote Sensor”

Each remote sensor on every A/V component should have an *IR Emitter Bug* placed over the sensor using the self-adhesive backside of the emitter. The *Emitter Bug’s* other end terminates in an RJ-45 (Category 5 or 5e) plug that plugs into a *QuickPort* wallplate Category 5 or 5e jack. This greatly simplifies installation, eliminating solder-type mini-plugs and non-standard wallplates. This Category 5 or 5e jack is *dedicated* to an IR control network and has *different wiring* than a standard jack. You will only be connecting the ORANGE, BROWN, and GREEN pairs. The other end of the cable runs back to the SMC.

At the SMC:

- Connect each of the *Emitter Bug* Category 5 or 5e cable wires to the corresponding colors on a numbered punch-down IDC block on the *1x9 Bridging Module*
- Connect each additonal Emitter Bug cable to a separate IDC block
- Repeat the process for cable coming from the Room IR Targets, with each room’s IR Category 5 or 5e cable connected to a numbered IDC block on the *Bridging Module*
- Use the last (#10) block on the 1x9 Bridging module to connect the DC power supply with the White-Green pair to GROUND or “-” and the White-Brown pair to 12 VOLT or “+”.

When properly connected, any remote control aimed at any of the *Room IR Targets* will control any of the A/V components connected with an *IR Emitter Bug*.

Take Note: Because IR commands are all coded differently and A/V components have different control codes, it is not necessary to dedicate any of the control architecture. A DVD player in a stack of components, for example, will, respond only to the properly coded signals from its own remote (or a properly programmed extra or “learning” remote) and simply ignore the commands meant for the AV receiver or VCR.

9.9 Indoor/Outdoor Home Camera Monitoring

An increasingly standard security feature in new homes is the installation of a video surveillance system. The *Leviton Integrated Networks Structured Media Home Monitoring Application* can provide this service by supporting multiple security video arrangements

There are two levels of home monitoring to consider:

A. *Direct monitoring* with the indoor and outdoor cameras directly connected to a dedicated TV and viewed on its auxiliary video inputs (VIDEO 2, VIDEO 3 or AUX IN).

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B. *Network monitoring* where the cameras are modulated and assigned a channel, and then "broadcast" over a pre-assigned "security" or monitoring channel (usually channel 75-80) for viewing on any TV connected to the coaxial cabling video distribution infrastructure. This approach also provides *Video Sequencing*, which automatically switches between up to 4 cameras to give a homeowner continual surveillance over several areas.

9.9.1 Indoor Security Camera

Leviton's *Decora Camera* is intended for indoor monitoring of rooms, hallways and open areas. It installs into a mud ring and is secured with the supplied top and bottom screws the same as any *Decora* device. The Décor Cam requires two cables:

- A RG-6 quad shield coaxial cable for the video signal (using the RCA female jack on the "pigtail" cord coming from the camera)
- A Category 5 or 5e cable to connect DC power to the camera because the Decora Cam is an active (powered) device.

Every planned location for these security cameras must be wired with both Category 5 or 5e and RG-6 quad shield cable

Take Note: While the *Decora Cam's* RCA output can also be connected to shielded audio/video RCA-type cables, such cable is usually costlier than RG-6 coax, more susceptible to noise and interference, and often not rated for in-wall use.

Before finalizing a location, first plug the camera in temporarily and check for problems such as:

- Direct room lighting or sunlight "washing out" the image
- Blind spots
- Cameras mounted too high or too low

To test the Decora Camera:

- Hook up the camera for power by connecting the Category 5 or 5e cable
- Plug a patchcord into the camera's RCA female pigtail
- Plug the other end of the patchcord into the VIDEO IN connector on the back of a portable TV (a TV with both a video and RF input can test the direct camera input as well as a modulator setting)
- Once your camera check is complete, you can finish your installation

Installers Tip: A Sony Watchman or equivalent with RF and AUX inputs makes an excellent, lightweight TV for testing the Decora Cam function.

Take Note: Remember, while the *Decora Cam* does have limited horizontal pan adjustment, for optimizing the view it is better to select the best location to begin with and use the adjustment lever to "fine tune" the camera.

9.9.2 Installing the Decora Camera

To connect the coaxial and Category 5 or 5e cables to the camera follow the wiring in the Indoor Camera Diagram:

- Run both the coaxial and Category 5 or 5e cables to the camera mud ring; run the other end of the cables to the SMC
- Connect the 6-inch RCA pigtail by connecting the signal wire to the screw terminal marked +VIDEO and the ground wire to the terminal marked VID GND
- Establish power by connecting the Brown pair of the Category 5 or 5e cable to the +12V DC terminal and the Green pair to the PWR GND terminal. Strip approximately 1/4" insulation off each lead and then twist both the striped and solid-colored wire of each pair together to increase current capacity. Insert the stripped, twisted-together ends of each pair into the terminal hole and tighten the set screw to ensure contact.
- Plug an RCA-to-F adapter into the camera's female RCA output jack
- Screw a terminated RG-6 coaxial cable into the other side of the adapter
- Check for any potential shorts.

9.9.3 Mounting the Decora Camera

To mount the camera:

- Push the coax and category 5 or 5e wires through the mud ring.
- Mount the camera to the mud ring using the 2 screws provided.

After installing the camera in the mud ring, check the viewing angle—should it require any adjustment, use a small screwdriver to gently remove the Decora Cam's front plastic cover below the lens window and above the power LED. Underneath is a small metal lever which pivots the internal camera assembly. Use it to arrive at the best viewing angle and snap the front plastic cover back in place. Once the camera is permanently secured in the mud ring and adjusted, use a Decora wallplate to trim the installation. The camera is now ready for use.

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Once connected, check the camera again using a portable TV.

9.9.4 Outdoor Camera (Leviton 48213-ECC):

Leviton's outdoor version of the *Decora Camera* is manufactured to be weather-resistant. Its cabling and termination procedure is similar to the *Decora Camera* above, The installer should use the same procedure for checking the location's suitability (using a portable TV and a temporary hook-up to check for lighting and positioning problems) as for the indoor camera.

To get the best results with the *Outdoor* camera:

- Do not point the camera at a direct light source, such as a porch light or street light and never at the sun
- Mount the camera higher than 6 feet from the ground or porch floor and high enough to prevent tampering
- *The ideal location is under an eave, gutter, porch, or an otherwise sheltered location that will protect the camera from direct exposure to rain and sun*

Follow the same instructions for connectorizing and testing the outdoor camera as you did for the indoor camera, but using the wiring in the Outdoor Camera Diagram.

9.9.5 Mounting the Outdoor Camera

- Remove the 4 screws from the bottom of the camera and *carefully* remove the lower plate. *If the plate is pulled or otherwise wrestled from the camera, the internal wiring can be damaged and the camera will not function properly*.
- Connect the 6-inch RCA pigtail by connecting the *signal* wire to the screw terminal marked YEL (yellow) and the *ground* wire to the terminal marked BLK (black)
- Establish power by connecting the Brown pair of the Cat 5 to the RED (+12V DC) terminal and the Green pair to the BLACK (Ground) terminal. Strip approximately 1/4" insulation off each lead and then twist both the striped and solid-colored wire of each pair together to increase current capacity. Insert the stripped, twisted-together ends of each pair into the terminal hole and tighten the set screw to ensure contact
- Connect the blue pair to the far right (white) screw terminal for the audio signal
- Dress the wires through the slotted opening between the camera and the plate
- The audio detection level is preset at the factory; to adjust, turn the small volume control on the printed circuit board with a screwdriver (clockwise to lower the level, counterclockwise to raise it)
- Check your wiring and replace the bottom plate
- Drill two 4mm diameter holes spaced .34mm apart on either side of the cable access hole
- Insert the two supplied plastic wall plugs into the holes
- Using the 2 supplied mounting screws, mount the camera to the outside wall
- Make sure the cables are pushed back inside the access hole and are not caught between the camera body and the wall
- Apply an approved foam sealer or gasket material between the camera and wall to protect against leaks

9.9.6 Powering the Cameras

Supplying power to either the indoor or outdoor camera is the same for both *direct* monitoring and *network* monitoring installations. —Power is supplied from the SMC by the DC Power Supply Module which consists of two components:

- *The 1X6 Power Distribution Board*
- *The AC/DC Converter*

To use the 1X6 Power Distribution Board, you'll be connecting a single camera DC to the "+" (12VDC) terminal and to the Ground terminal. To do this:

- See Section 9.4.4 if installing a DC Power Supply Module
- Run the Category 5 or 5e cable from each camera to a separate punch down termination on a Cat 5 module in the SMC and terminate following usual procedures
- Use the special Category 5 or 5e patch cord wye cable to provide power from the DC Distribution Module and audio signal to the Video Sequencer (only outdoor camera has audio)
- For the power connection insert the Brown pair of the cable into the 12VDC terminal and the Green and Orange pairs into the "–" or NEGATIVE (ground) terminal. Tighten the set screws
- Once the DC power supply connected to the board and is plugged in, the cameras are powered

9.9.7 Direct Video Monitoring

The simplest security surveillance is called *direct video monitoring*. With this system, the cameras are connected directly to a single TV. Your client will have to decide the TV that will have the dedicated status. A kitchen location, for instance, allows parents to work while watching their children. This is a limited arrangement as it only allows monitoring from one location. Audio is not available in Direct Monitoring Mode.

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To install a single TV set for direct monitoring follow the Indoor & Outdoor Camera Diagrams for direct monitoring:

- Plug the F-connector terminated end of the RG-6 quad shield into any accessible auxiliary video input on the back of the set (usually designated VIDEO IN 1, 2 or AUX IN 1, 2)
- Run the coaxial cables from the cameras to the TV set by passing them through the SMC first; this will comply with the easy-access star wiring topology and access the DC power supply
- Use a female-female coupler in the SMC to couple the coaxial cable from the camera location to the coaxial cable leading to the TV set where the camera's video will be displayed.
- Make sure you leave enough service loop on each cable for other future connections in the SMC

9.9.8 Network Video Monitoring

Instead of limiting surveillance viewing to a single TV set, *network video monitoring* allows access on multiple TV sets via a dedicated "security channel. This arrangement follows the Indoor & Outdoor Camera Connection Diagrams for network Monitoring and requires four components in this order:

1. *Video Sequencer* (Leviton 48213-CVS): The sequencer takes the input from both the Decora Cam and the Outdoor Camera (it can handle up to 4 cameras to cover a complete perimeter) and combines it into a single output signal. The sequencer switches between the different cameras every 2 to 30 seconds depending on the setting of the *"TIME ADJUST"* control knob on the front of the sequencer.
2. *SMC Video Modulator* (Leviton 48213-VMA): The modulator converts the combined cameras output signal (baseband) from the Video Sequencer into a cable channel signal (broadband) with a channel number, usually between 75-80 (our notch filter works in this channel range).
3. *3X8 Bi-Directional Video Amplifier:* When the *Video Modulator* is connected to the amplifier's AUX input, the "security channel" from the modulator is fed to every TV in the home. If, for example, the modulator is set for channel 75, anyone changing the channel on any TV to channel 75 can watch what's on each video camera as the *Video Sequencer* switches them.
4. *RF Notch Filter:* This component essentially "cleans out" the cable TV channel range between 75-80 so that the assigned "security channel" is kept free of interference; it also prevents the modulator signal from reaching into the CATV provider network. The *Notch Filter* is inserted into the cable TV coaxial feed just before the Cable In (CI) input on the 3x8 Bi-Directional Video Module so that the cable TV signal inside the amplifier is already filtered before the "security channel" is added to the cable mix.

Installing the Networked Video Monitoring Package

Your networked video monitoring package starts at the SMC with the *3X8 Bi-Directional Video Module* that was referred to in the previous section. Be sure that it's installed properly and operating correctly before you begin installing the other components.

Install the remaining components in this order:

1. Install the *RF Notch Filter* in-line between the incoming cable television coaxial line and the *3x8 Bi-Directional Video Module's* Cable Input (CI). Note: Once the *Notch Filter* is installed, channels 75-80 are reserved for Security Video cameras. Check with the local cable TV system to determine if any programming is on those channels.
2. Install the *Video Sequencer* in the SMC. Remember to plug-in DC power by connecting to the DC Power Supply Module or using the unit's supplied DC power supply. Connect the F-connector terminated coaxial cables from each camera to the *Video Sequencer's* video outputs using the "f" to RCA adapters. Connect the audio output from the Outdoor Cameras to the Video Sequencer's input.
3. Run a suitable "patchcord" length of terminated RG-6 quad shield from the *3x8 Bi-Directional Video Module's* AUX IN 1 or 2 jack which will connect to the RF OUTPUT of the Leviton's *Video Modulator*
4. Prepare the *Video Modulator:* Before installing, you should assign the channel that the *Modulator* will use to convert the *Sequencer* camera signal to a coaxial-compatible signal.
5. Install the SMC *Video Modulator* in the SMC using the supplied bracket. Connect the Video Sequencer's VIDEO OUTPUT jack to the VIDEO IN jack of the *Video Modulator* using a suitable length of video cable (RCA to RCA). Connect the Modulator's supplied audio cable to the Sequencer's audio output and plug it into the Modulator. Connect the RG-6 quad shield "patchcord" discussed in step 3 coming from the *3x8 Bi-Directional Video Module's* AUX IN 1 or 2 jack to the Video Sequencer's output. Connect the *Video Modulator's* power input jack to the DC Power Supply Module or it's supplied AC/DC Power Supply.

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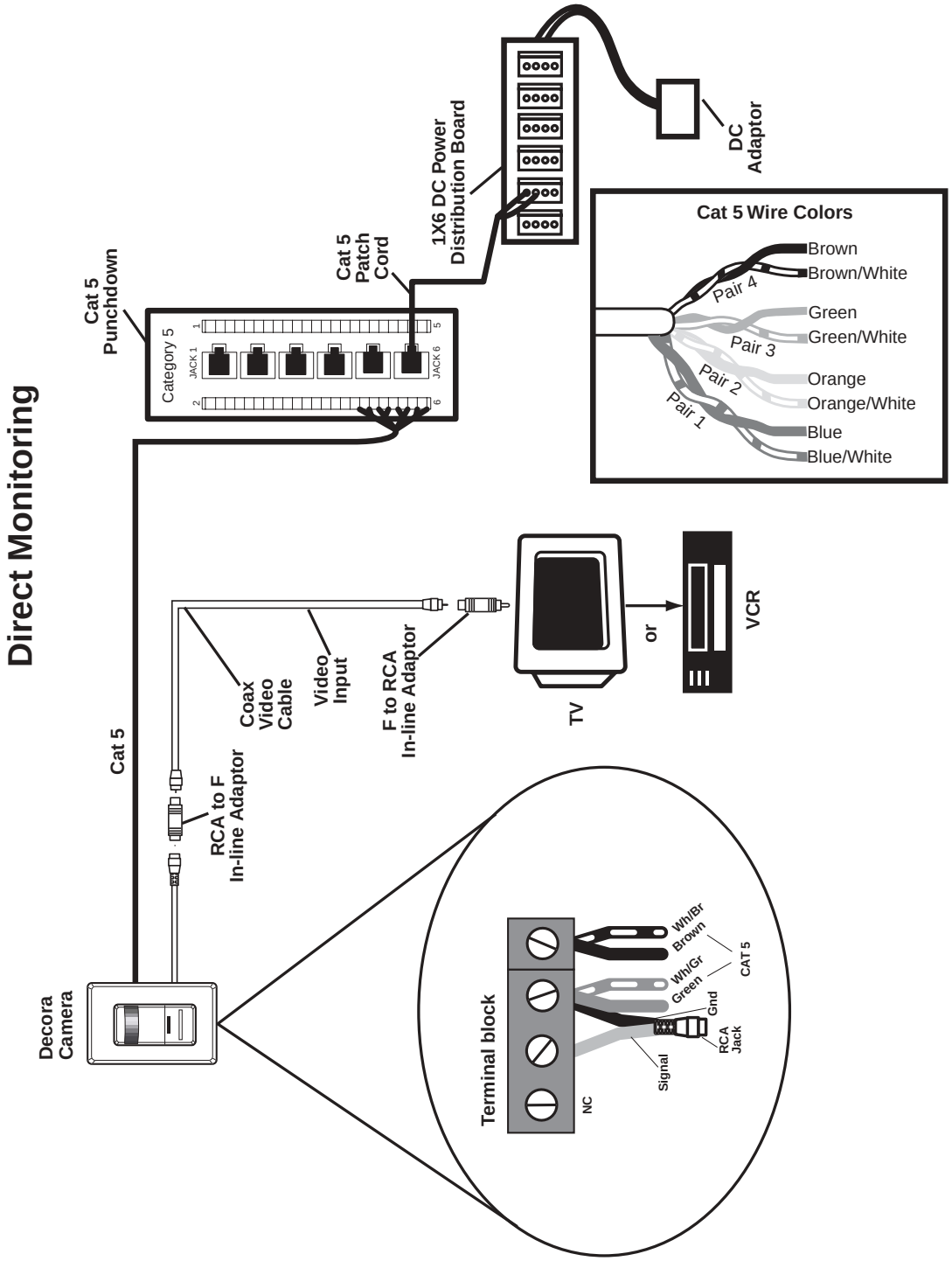
INDOOR CAMERA CONNECTION DIAGRAM



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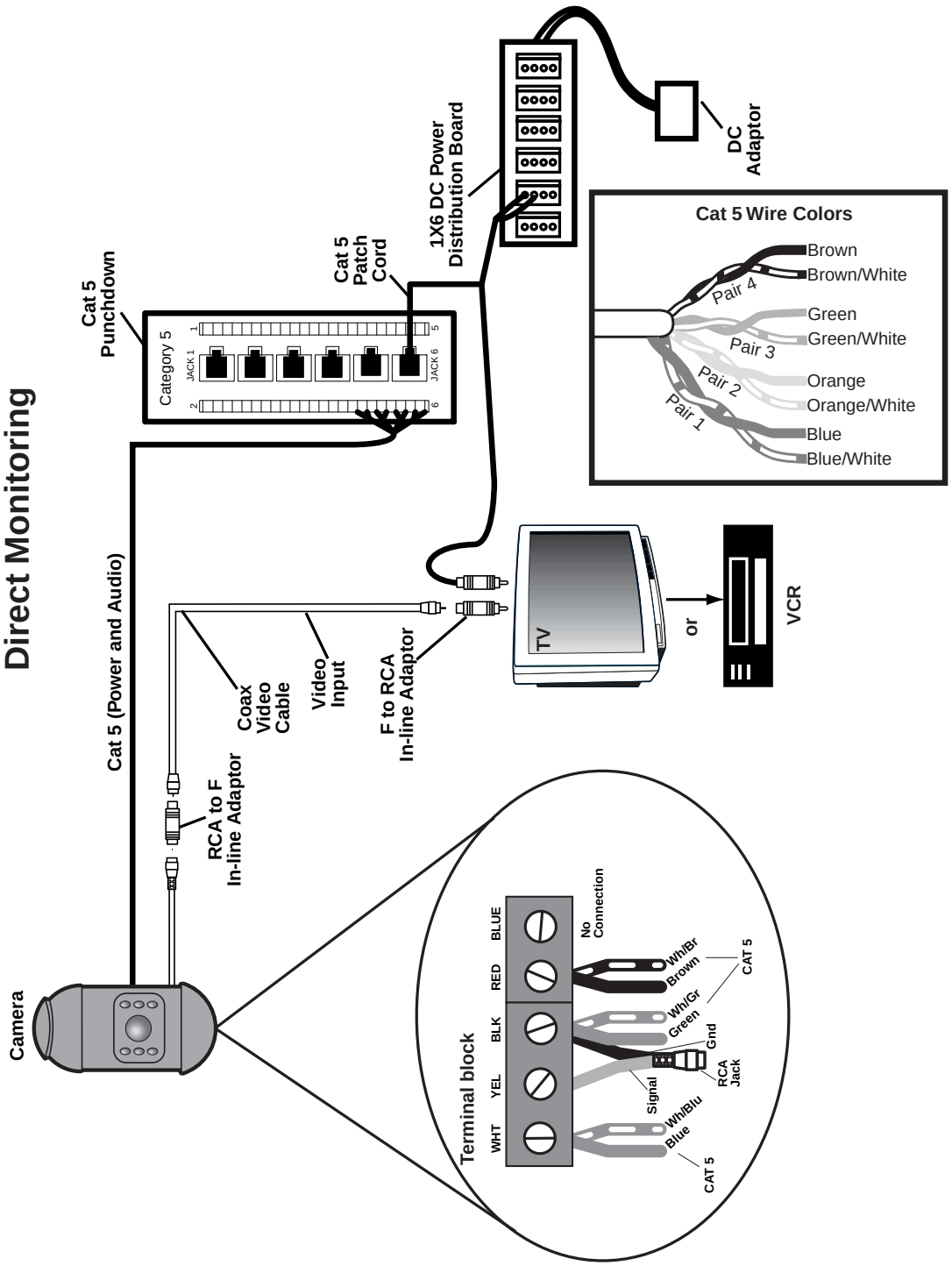
OUTDOOR CAMERA CONNECTION DIAGRAM



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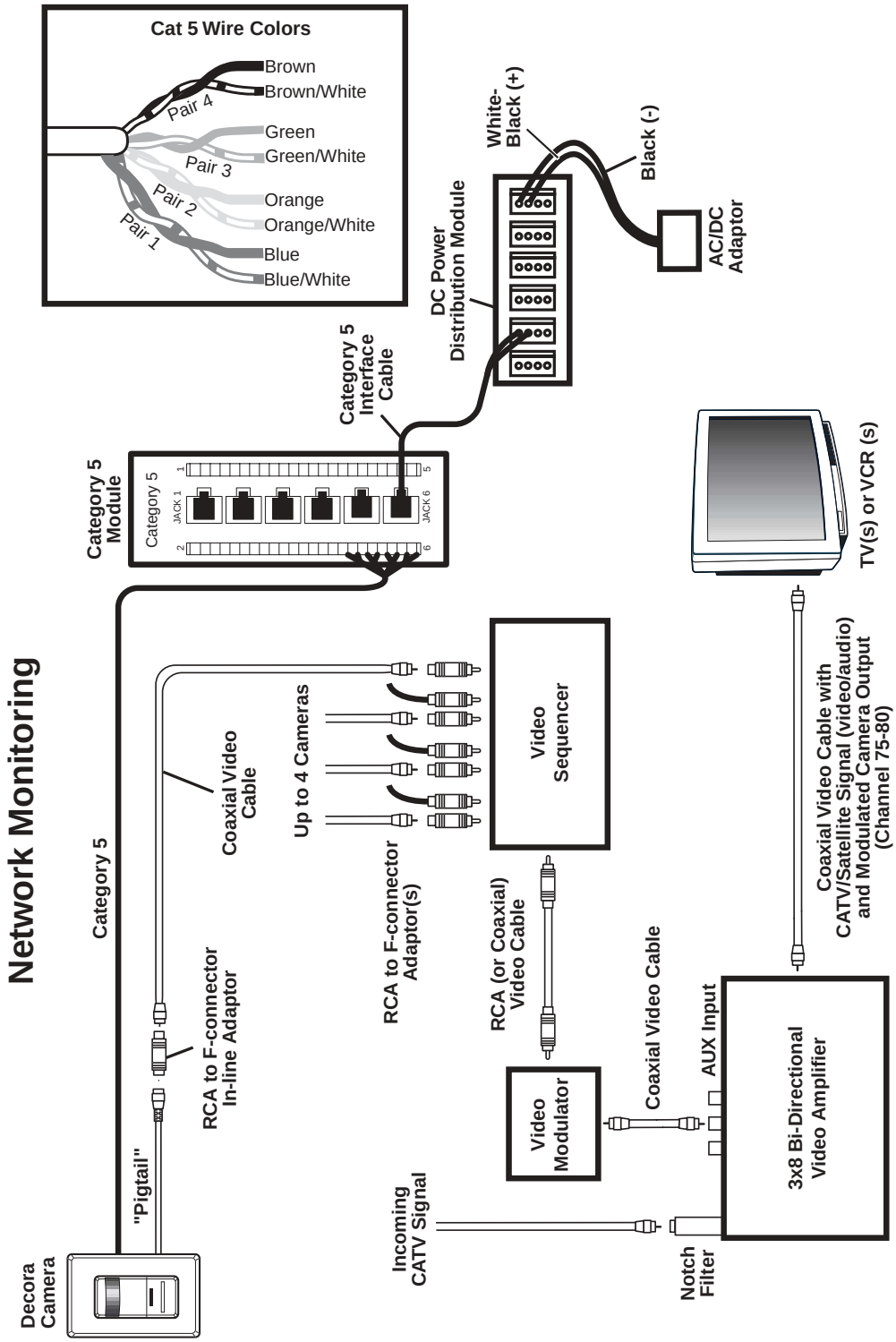
INDOOR CAMERA CONNECTION DIAGRAM



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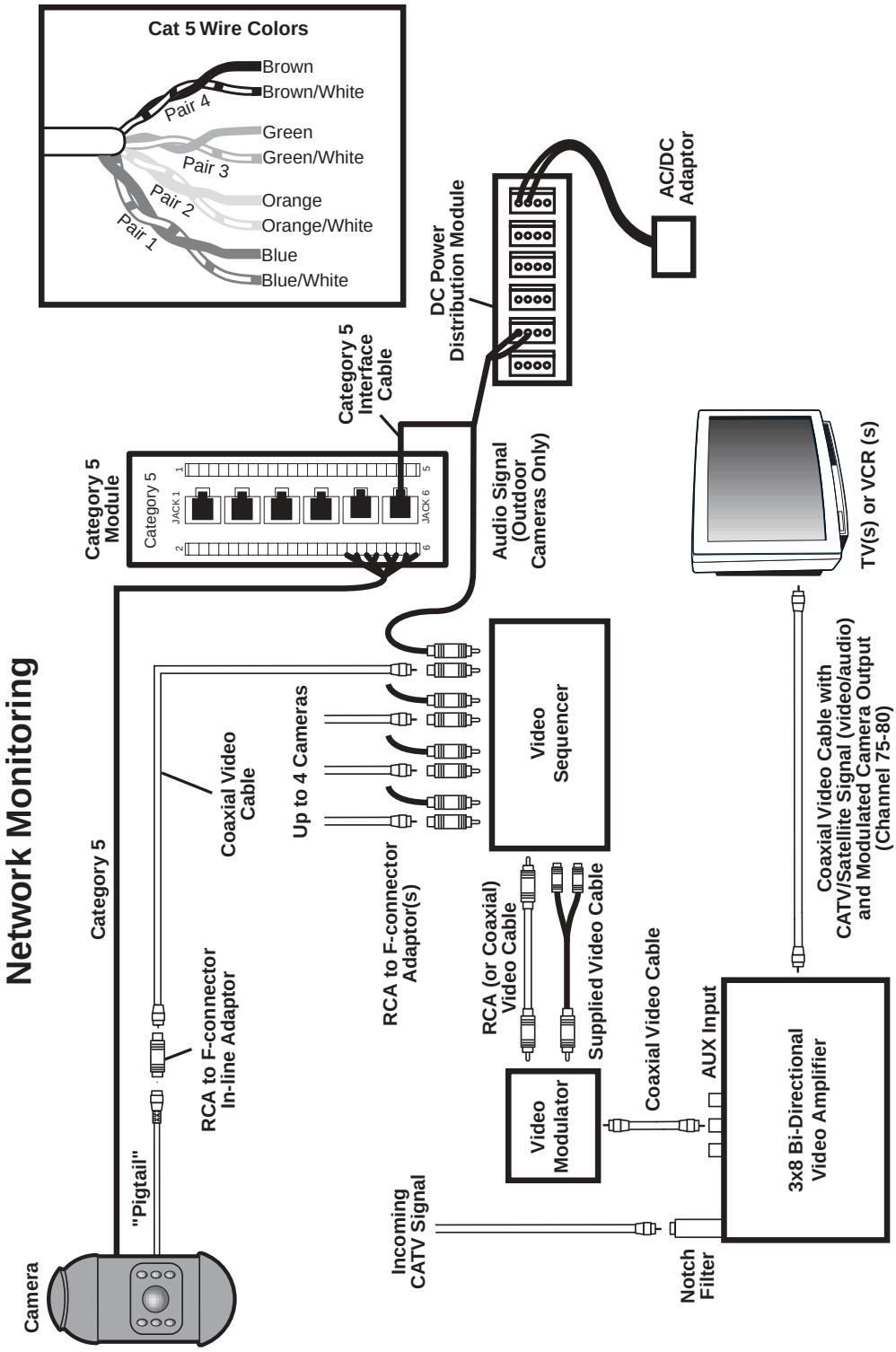
OUTDOOR CAMERA CONNECTION DIAGRAM



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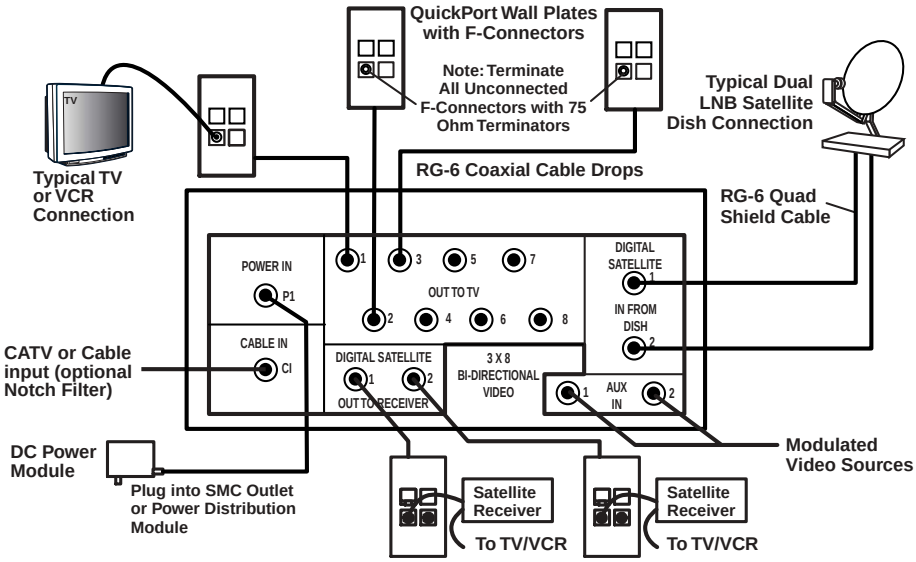
Multi-Room Video Distribution Using 3x8 Bi-Directional Video Distribution Module



Operating the Networked Video Monitoring Package

Once the cameras and modulator are connected properly, the only adjustment that must be made is on the Video Sequencer. To make these adjustments:

- Check that the unit is switched ON.
- Adjust the interval between the two, three or four connected cameras (selectable from 2 seconds to 30 seconds) by using the "TIME ADJUST" rotary control on the far left of the back panel
- To bypass the automatic sequencing, press the first of the two right pushbuttons to MANU (manual) mode and then press the second CHANNEL button to move through the camera signals.
- Once the Sequencer is adjusted, the Home Monitoring application is ready for use.

Take Note: If there is only one camera connected to the Sequencer that camera will stay on constantly—the Sequencer only selects between active channels. Once the Sequencer is active, tune any TV set in the house connected to an active coaxial video jack to your pre-selected Monitoring channel (between 75-80) and you should see the camera's video signal.

9.10 Multi-Room Video Application

This option lets the user distribute high-quality video and stereo audio from an A/V source component (such as a DVD changer or an A/V surround receiver) to any TV connected to the coaxial cable infrastructure. It provides a home "entertainment channel" much like the Home Monitoring option provides a dedicated "security channel."

This arrangement requires four components in this order:

1. *The Desktop Stereo Modulator (Leviton 48210-DSM)*: The modulator converts the combined audio/video composite output signal (baseband) from a DVD player/changer or other source (such as an A/V receiver) component into a cable channel signal (broadband) with a channel number, usually between 75-80. The A/V Component Modulator accepts an RCA video input as well as left and right stereo inputs.
2. *3X8 Bi-Directional Video Amplifier:* Covered under Active Video Distribution in section 9.4.3, when the *Video Modulator* is connected to the amplifier's AUX input, the "entertainment channel" from the modulator is fed to every TV in the home. If, for example, the modulator is set for channel 77, anyone changing the channel on any TV to channel 77 can watch what's on the DVD player.
3. *RF Notch Filter:* Also covered in Home Monitoring with Security Video Cameras/Network Monitoring in section 9.9.8, this component essentially "cleans out" the cable TV channel range between 75-80- so that the assigned "entertainment channel" is kept free of interference; it also prevents the modulator signal from reaching into the CATV provider network. The *Notch Filter* is inserted into the cable TV coaxial feed just before the Cable In (CI) input on the *3x8 Bi-Directional Video Module* so that the cable TV signal inside the amplifier is already filtered before the "entertainment channel" is added to the cable mix.

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4. *Multi-Room IR Control:* Covered under Multi-Room Stereo in section 9.6, the same IR Target and Emitter package is used to distribute remote-control commands from the remote viewing location (such as a master bedroom) back to the source A/V component (usually in the entertainment center). Note that the IR Emitters attach directly to the source A/V component; the *Desktop Stereo Modulator* is not part of the remote "switching" function but simply provides distribution of the A/V signal over the home's coaxial cabling infrastructure.

9.10.1 Installing Multi-Room Video

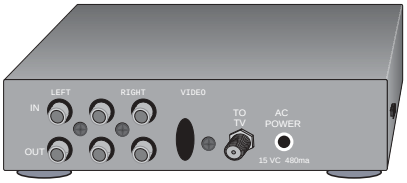
Note: *If installing both the Multi-Room Video and the Home Monitoring Security Camera options, you must assign separate channels between 75-80 for each application. To avoid bleedover between channels, it is recommended you leave at least one adjacent unused channel between each channel used. If the Multi-Room Video "entertainment channel" is Channel 77, use Channel 79 for the Home Monitoring "security channel."*

Your Multi-Room Video package starts at the SMC with the *3X8 Bi-Directional Video Module*, RF Notch Filter and Multi-Room IR Control that were referred to in the previous sections. Be sure that they are installed properly and operating correctly before you begin installing the other components.

Install the remaining components in this order:

5. Install the *Desktop Stereo Modulator* at the source A/V component. Run an RCA "audio/video"—type 3-way patchcord from the source components VIDEO OUT (yellow), LEFT AUDIO OUT (can be black, white or grey) and RIGHT AUDIO OUT (usually red). Note: if you are using an A/V receiver as the source component, make sure you use the correct LINE OUT orAUX OUT jacks on the rear (consult the receiver's owners' manual). Using an A/V receiver has the advantage of enabling switching between multiple components plugged-into it including DVD players, VCR's, CD players, etc. Plug the other end of the RCA cable into the *Desktop Stereo Modulator's* rear panel to the corresponding VIDEO IN, AUDIO IN/RIGHT and AUDIO IN/LEFT.

Desktop Stereo Modulator - Front



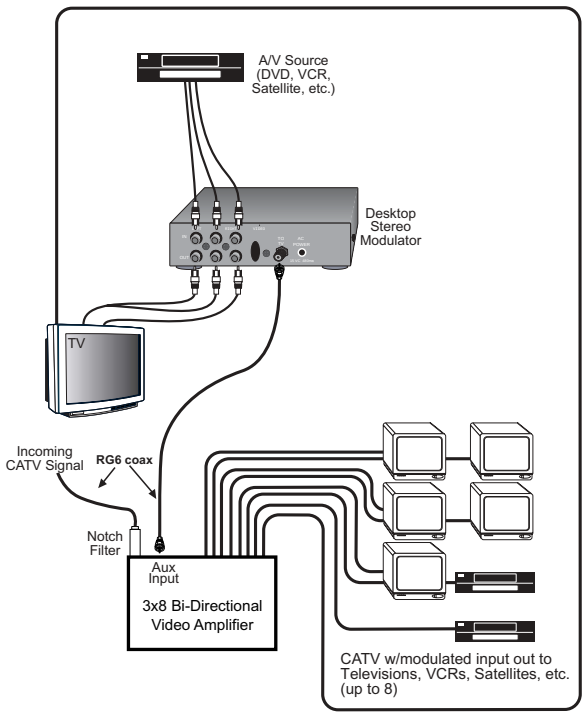
Desktop Stereo Modulator - Back

6. Using the supplied AC Power adapter only, plug the *Desktop Stereo Modulator* into an AC outlet or into the SWITCHED accessory outlet on the back of the source component (such as an A/V surround receiver).

7. Connect the *Desktop Stereo Modulator's* RF OUTPUT to a terminated length of RG-6 Quad-Shield coaxial cable, and connect the other end to an unused QuickPort F connector already home-run back to the SMC.

8. Connect the other end of the coaxial cable in the SMC to one of the two AUX inputs on the *3x8 Bi-Directional Video Module's* (AUX IN 1 or 2). Make sure the RF Notch Filter is already installed as outlined in Section 9.8.8/Network Monitoring.

9. Prepare the *Desktop Stereo Modulator* by programming its channel. This is a simple procedure and uses the small pushbutton on the front panel. Here's an example using Channel 77: First, select a mode by pressing both UP and DOWN buttons simultaneously for seven seconds. This will change the mode and allow you to choose a new one. The new mode will display (CA for CATV, or UH for UHF). Choose mode CA. The channel will devert to the default



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(channel 54) for that mode. Simply press the button UP until the number 77 appears. The Modulator is now programmed to "broadcast" the A/V source component over Channel 77 across the whole-house coaxial cable infrastructure. Note: if you do not see the picture on the desired Channel, first check the immediate surrounding channels to make sure the Modulator was programmed correctly, or that the TV and modulator are tuned to the same channel. Also, be sure that the TV tuner is set to the same "mode", i.e. "CATV" or "cable".

9.11 What You Need to Know

- Terminations at modules, jacks, and panels can make or break a job. They must be done precisely with tools made for low-voltage cable work. Every installer must pay attention to the untwisting of each cable pair, the amount of cable jacket that is removed, and correct color matching of cable to termination point.
- Coaxial cable is best terminated with compression or crimp-on connectors.
- When installing structured cabling systems, always leave a service loop at each termination and mark both ends of each cable for easy identification.
- When installing cable in the SMC, remember to put phone, data, speaker, and IR on the left and video cable on the right.
- Through its wide variety of modules, splitters, panels, and other components, Leviton offers both *Essential* and *Enhanced* infrastructures that will meet all of your customer's structured cabling needs.
- Reread and follow the cable installation rules listed in this chapter.
- Through the use of modules, splitters, and amplifiers, Leviton offers the installer the choice of passive, hybrid, and active video distribution.
- Speakers and amplifiers must be matched for the appropriate impedance levels in order to avoid damage to the amplifier.
- Every room that is wired for sound is a good candidate for infrared (IR) controls as well.
- Depending on your client's needs, you can install both direct and network levels of home monitoring. Camera placement and tests are critical to the success of the system.

9.12 TERMINATING THE CABLE

When Terminating Category 5 or 5e Cable

- Leave a service loop, or length of extra cable, at every wallplate; Leviton recommends 24 inches for all copper cable and 36 inches for all fiber
- Follow the Leviton recommended cable management techniques at the SMC whenever possible; these call for coax cable to enter the right side of the box, data/ and audio/video on the left
- The jacket must touch the jack when cabling. Normally 2-1/2 to 3 inches of cable jacket is removed when cabling a jacket
- Untwist your cable pairs no more than 1/2 inch; as with the cable itself, remove only as much of the wire jacket as necessary to make the termination (the 110 Termination Deck on Leviton jacks is 1/2 inch long, which simplifies your compliance with this industry standard)
- Be sure to install the color-coded wires at their correct, corresponding termination points
- Always use a 110 punchdown/termination tool on 110 punchdown termination points
- Label each end of the cable appropriately and maintain a wiring chart inside the SMC that identifies the cable and its termination point
- Category 5 or 5e cable should never be spliced; if a run is damaged, replace the entire length of cable

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DOCUMENTATION AND TESTING

10 Documentation and Testing

Low-voltage cable is not as durable as other types of cable, and it has been specifically designed to meet strict requirements. Low voltage cable follows its own industry standard and requires specific tools and care to maintain the integrity of a structured wire system. It is more easily damaged during rough-in and drywall installation than other electrical cable and damage can go unnoticed. For these reasons, it's important that low-voltage cable is tested thoroughly, a relatively simple process. Testing verifies that no faults occurred during the installation; problems occurring later will be due to other reasons such as system abuse or damage from individuals other than the installer.

10.1 Labels

Label all of your cable ends BEFORE pulling them to their termination points. The importance of properly labeling your various low-voltage cables becomes readily apparent during the testing phase. Accurate test results come, in part, from accurate labeling of the cables both at the distribution point in the Structured Media Center (SMC) and at the point of termination. The numbers or letters on the cables assure accurate testing (you don't want to discover that the reason the wire is producing an incorrect reading is because it has different labels on each of its ends).

10.2 Documentation

All testing must be recorded and documented. Documentation is mandatory for Leviton Integrated Networks Certified System. Leviton supplies cable test documentation forms at the end of this chapter. You may send copies of hand entered data on the test documentation forms or use electronic versions of these forms. If you use the paper forms, please make several copies so that you can complete them during testing at your job sites.

10.3 Visual Inspection Immediately after Pre-wire

Complete a thorough visual inspection of all cables and check for the following:

- All cables are labeled on both ends for easy identification
- Obvious damage to the cable
- Incorrect bend radii (minimum of 4 times the cable diameter or 1" for Category 5 or 5e and 2" for RG-6 quad shield cables)
- Wire color matching to assure the right access line is assigned to the right set of pairs
- Tip and ring or (+) and (-) assigned to the proper pins

10.4 Basic Testing

A normal device load that trips a circuit breaker alerts an electrician that there's a problem in the circuit. Problems with low-voltage wiring installations do not always show up as readily as those with AC cable. Testing is critical to confirm that the system is working properly.

In most cases, you will be performing your tests before any dial tone is available from the telephone service provider, or signal is available from the CATV service provider, or a TV or DSS antenna has been installed. Therefore, the testing described below assumes that no signal or attached consumer electronics equipment is available.

Basic testing covers all but Category 5 or 5e testing and can be used for the following cables:

- Category 5 or 5e cable that does not terminate in Category 5 or 5e jacks at both ends of the run (no Cat 5 Module in the SMC and no Category 5 or 5e jack at the wallplate). Examples of such Category 5 or 5e cable runs are:
  - Inbound cable from the telephone service provider demarcation point
  - Category 5 or 5e cable used for powering video cameras or IR targets and IR emitters
  - Category 5 or 5e cable for telephones that terminate on the 1X9 Bridged Telephone Module

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• Audio cable (for speakers and volume controls)

• RG-6 quad shield cable

To perform your basic tests, you'll need the testing tools listed below:

• Multimeter or Volt-Ohm meter

• Category 5 or 5e Field Tester

• Cable Tester for coaxial and other cable

• Modular Plug Breakout Adapter

• Tone Test Set

• Inductive Probe

• Craftsperson's Handset (buttset)

All tests should be recorded and documented. This is mandatory for Leviton Integrated Networks Certified System Ten Year Application Assurance and Ten Year Extended Warranty.

WARNING: Do not do any testing on energized wiring or circuits. Disconnect all sources of electric current before starting your tests. Be sure that all distribution panels and modules are disconnected from either the AC or DC modules.

In basic testing, you will be testing the cables for the following:

• Shorts

• Opens

• Crosses

• Splits

• Reversed polarity or rolls

• Final verification

DEFINITIONS

OPEN: *Also known as an open fault. This means that the circuit is not complete or the cable/fiber is broken*

SHORT: *An incomplete circuit caused by a hot conductor coming into contact with a ground or metal component; the current does not follow its intended path*

CROSS: *The occurrence of a short between two terminals; usually occurs when too much bare copper conductor is stripped and then the end is not trimmed after connection*

SPLIT: *This occurs when two wires of a pair are split or separated and improperly matched with wires from another pair*

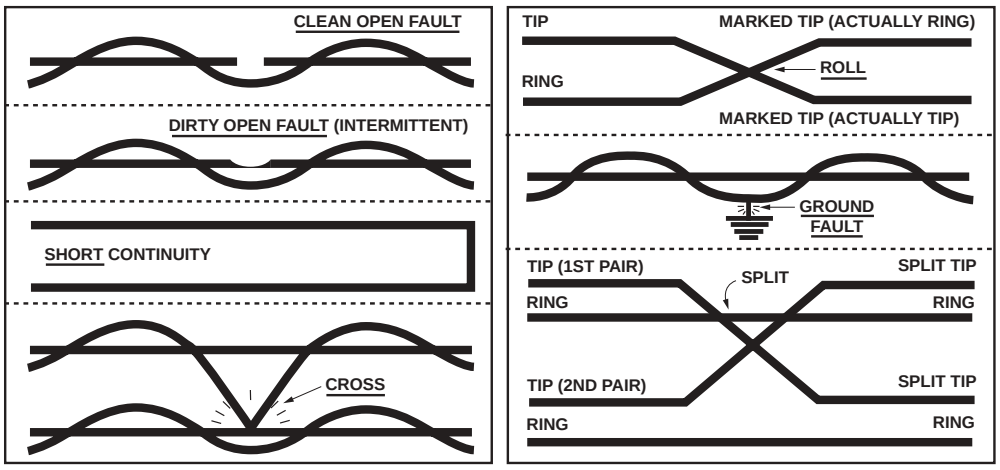
REVERSED POLARITY OR ROLLS: *A rolled pair results when the tip and ring leads are reversed in connecting to the network*

Installer's Tip: During rough in, continually do visual inspections for damaged cables. Look for the most obvious problems before spending too much time doing instrument testing.

10.4.1 Category 5 or 5e UTP in Non-Category 5 or 5e Compliant Cable Runs

Category 5 or 5e cable that terminates on the 1x9 Bridged Telephone Module in the SMC may be tested for continuity in two ways. In the first and preferred method, you will use a Category 5 or 5e field tester. Plug the remote tester into a Category 5 or 5e jack at any wallplate. Plug the hand-held tester into another jack connected to a cable that also terminates in the 1X9 module. Run the Wire Map test on the Category 5 or 5e tester hand-held unit. This test will indicate any splits, rolls, continuity, or shorts in

Common Wiring Faults



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between the handheld and remote tester, through the 1x9 Bridged Telephone Module. Leave the remote where it is, and move the handheld unit to plug into all jacks connected via cable to the 1x9 Bridged Telephone Module. All cable runs must pass the test. If any cable run fails or all runs fail, verify that all punchdowns at the jack are correct and follow the T568A pattern (see color code on the jack label). Then verify all punchdowns are correct at the 1x9 Bridged Telephone Module. If all punchdowns look correct, disconnect one cable at a time from the punchdown IDC, and retest at a jack terminated on a cable that remains connected to the 1x9 Bridged Telephone Module until the trouble is found and corrected.

You can use a tester similar to the Microtest MICROSCANNER™ to detect miswires, location, and run lengths for the Category 5 or 5e cable that does not terminate at both ends on category-rated jacks, RG-6 quad shield cable, speaker wiring, or alarm wiring. The tester can find pair polarity (wire map), excessive length, shorts, opens, and other problems in your cable runs. It can also help you determine if your cable labeling is correct by enabling you to locate which cables terminate in various rooms.

Please follow the directions included with these testers to check your wiring and solve any problems that may exist.

It's much better to solve any such problems immediately and save the expense and embarrassment of a callback from the builder or homeowner. Document the test results for your records on copies of the provided cable test form included on page 10-8 of this manual.

Another testing tool, the Modular Plug Breakout Adapter, tests any 6- or 8-position modular jack (and can be used in series) while using the Tone Test Set or the Craftperson's Handset. Alligator clips connect the contacts to any test apparatus or to a Lineman's Test Set. These test tools allow you to test that any given pair terminates at the correct position on the jack. These tools can be especially useful when terminating more than one phone line (up to four different phone numbers) on jacks throughout the dwelling.

Should the various cable runs not pass the test you can use the Inductive Speaker Probe, used in combination with the Tone Test Set, to detect audible frequency tones so wires, cables, and metallic circuits can be traced and identified without damage to their insulation. The Inductive Speaker Probe's duckbill and needlepoint tips provide great flexibility for inspecting wiring in tight spots, cables under tension, or larger cable bundles. In noisy environments, a buttset can be attached to the probe's connecting tabs.

You must record all test results, by cable number and location, on the forms provided at the end of this chapter.

10.4.2 Audio Cable

For unterminated audio cable, check for an open between the wires in the speaker or volume control audio cable.

For terminated audio cable, check to see that the resistance reading of the cable from the 1x6 Audio Bridging Module in the SMC, is nearly the same as the resistance of the terminals on the volume control or speaker to which the audio cable run is terminated. A measurement close to the resistance of the volume control or speaker indicates the cable is continuous and without shorts.

10.4.3 RG-6 Quad Shield Cable

For RG-6 quad shield cable runs, use the MicroTest Microscanner to determine shorts, continuity, termination location (for checking labeling) and length of cable. As a less effective alternative, for unterminated RG-6 quad shield cable, use a multimeter or volt-ohm meter to check the resistance between the shield and center conductor on RG-6 quad shield cable. If the meter shows a finite resistance reading (below 100 K-ohms), then the cable has a short and that cable run fails the test.

For RG-6 coax that is terminated in a Leviton 1xN splitter, or in a run with a 75 Ohm termination cap, the resistance measurement should be near 75 Ohms to pass the test.

A coax cable tester will indicate faults and breaks in coax cable.

Prior to the installation of the end point device (TV, VCR, etc.), the cable can be tested by plugging it into the back of a small, portable TV.

10.5 Category 5 or 5e Testing

A measurement must be done for one of the following:

- Link
- Channel

A link (also called a Basic Link) is the permanent part of the cable run. It can be up to 295 conductor feet (90 meters) long from the SMC to the termination point.

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Leviton recommends one of the following Category 5/5e field testers:

The following companies also sell their product through other companies under other product names; you are advised to ask which of these companies is the actual manufacturer of the tester.

Agilent Technologies

753 Forrest Street
Marlborough, MA 01752
800-418-7111
508-486-0400
Fax: 508-786-9700
www.scope.com
sales@scope.com

Product

Wirescope 155 Cable Analyzer , WireScope 350 Fiber SmartProbe+

Datacom Textron

11001 31st Place West
Everett, WA 98204
800-468-5557
425-355-0590
Fax: 425-290-1600
www.datacom.textron.com

Product

LANcat® Installer Cable Tester, LANcat® System 5 Cable Tester and Talk Set, Optical Loss Measuring System LANcat® System 6 Cable Tester and Talk Set, FIBERcat(tm), NXT Network Test

Fluke Corporation

6920 Seaway Blvd, PO Box 9090
Everett, WA 98206
800-44-FLUKE (Customer Support)
www.fluke.com/nettools/

Product

DSP-100 CableMeter, DSP-100/SR Cable Meter DSP-2000 CableAnalyzer, DSP-FTK Fiber Test Kit (MM), LS-1310/1550 Fiber Test Kit (SM), Fluke 140 Tone Probe & Fluke 620 LAN Cable Meter DSP 4000v

Wavetek Wandel Goltermann

1030 Swabia Ct.
Research Triangle Park, NC,
27709-9441
800-729-9441
www.wwgsolutions.com
sales@wwgsolutions.com

Product

LT 8000, LT 8100, LT 8155LT 8000, LT 8100, LT 8155, 8600, 8600TSP & Fiber Test

Non-category rated applications, including coaxial cable, speaker cable and Category 5 or 5e cable not terminated in Category 5 or 5e jacks:

Microtest, Inc.

4747 North 22nd Street
Phoenix, AZ 85016-4708
800-526-9675
602-952-6400
Fax: 602-952-6401
www.microtest.com
sales@microtest.com

Product

****MicroScanner, *Microscanner Pro, PentaScanner 350, OmniScanner 2, OmniFiber, CertiFiber***

A channel (or User Model) includes the patching or equipment cords after they are added onto the link. The total allowable length for a channel is approximately 345 conductor feet (100 meters). The equipment cords, patch cords, and jumpers cannot exceed 32 feet in total length.

For field testing Category 5 or 5e cable, your test instruments must meet or exceed the applicable requirements in TSB-67. Commercially available instruments will specify whether they meet Level 1 or Level 2 accuracy. You will want to use those that meet Level 2. To meet TSB-67 standards, the Category 5 or 5e testers must be able to perform the aforementioned tests for length for all pairs of an installed link, attenuation, and Near End Cross Talk (NEXT). Testers may also measure for delay on an installed link, that is, the time it takes for a signal to travel from one point to another.

Take Note: A non-TIA/EIA-570-A system that passes Category 5 or 5e testing does not make it TIA/EIA-570-A compliant.

Test Rules for Category 5 or 5e Cable

- ***Cabling and components cannot be moved during testing***
- ***Both pass/fail indications and the actual measured values (frequencies) should be recorded***
- ***Reconfiguration might require re-testing***
- ***Qualified adapter cords should be used to attach the test instruments to the link under inspection***
- ***If you make a channel test, the end-user patch cords should be tested in place***
- ***The field tester must meet TSB-67 accuracy requirements for Level 1 or 2***

Your Category 5 or 5e field tester will perform automatic testing of all required EIA/TIA-568-A and EIA/TIA-570-A parameters for Category 5 or 5e cable links. Follow the instructions for auto testing that come with your Category 5 or 5e field tester.

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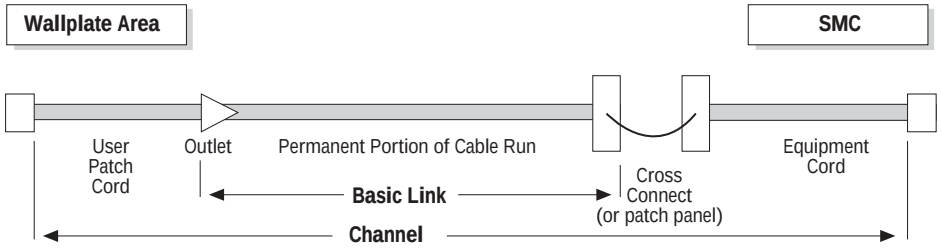

"Basic Link" Test Configuration	"Channel" Test Configuration
- Covers just the permanent portion of cable run - Intended primarily for cable installers who must test cable before patch cords and network equipment are installed	- Measures end-to-end cable run performance - More comprehensive test coverage (See comments, next page)

Please note that Category 5 or 5e auto testing using your Category 5 or 5e tester can be used ONLY on those Category 5 or 5e cable runs that terminate in a Category 5 or 5e Module in the SMC AND at a Category 5 or 5e jack at the wallplate. Your Category 5 or 5e test equipment requires you to plug in test equipment at both the SMC Category 5 or 5e Module and the wallplate Category 5 or 5e jack on the same link to perform the auto test routines. You will need to enter the cable number and then record the test result, Pass or Fail, as displayed on your tester. Most testers will record the pass/fail information internally and then allow you to download the information to a PC file. Follow the instructions that come with your Category 5 or 5e field tester to record and down load test information.

For Leviton Integrated Networks Certified System requirements, Leviton will accept electronic files, file printouts, or copies of hand entered data on the test documentation forms provided at the end of this chapter. If you use the forms, please make several copies so that you can complete them at your job sites.

Leviton and other suppliers manufacture equipment for testing low voltage wiring. Two key instruments from Leviton are the Tone Test Set and the Inductive Speaker Probe. Used together, these instruments will:

- Locate individual wires in a horizontal run along with any breaks or terminations that might be present
- Test for continuity
- Check for shorts and opens
- Identify Tip and Ring polarity
- Identify the line condition for CLEAR LINE with dial tone, BUSY LINE and RINGING LINE

The low-cost Tone Test Set can test for all types of wire applications including telephone, data, CATV, HVAC systems, and security/fire alarms. Results are shown on an easy-to-read LED. Telco standard 6A-type alligator clips with piercing pins securely grip 66-clips, screw heads, screw bodies, and wire-wrapped or threaded terminals, allowing testing of all types of configurations. A 6-position, 2-conductor plug lead is also provided for connection to modular jacks.

10.6 Final Residential Wiring Verification – Telephone Wiring

With the dial tone installed and all initial testing completed, final verification testing can be done with either a buttset or a telephone set.

To perform the final testing:

- Connect to the NID (network interface device) at the demarcation point.
- Go off-hook and receive dial tone.
- If a test number is available, call it and receive a return call (check with the phone company about test lines). Listen for clear transmission. Confirm that the digits dialed will stop dial tone and that dial tone resumes when the phone is hung up and then taken off hook again.
- If these tests fail, either the line has not been installed or the fault is in the access lines to the phone company, in which case the phone company should be contacted.
- Repeat the test for each phone line at the demarcation point.
- Connect the NID to the premises wiring.
- Go to each outlet in turn and repeat the test for every installed line (at each jack).

If a failure is encountered during the final verification test:

- Check the wiring to the jack for proper connections and check the wiring (including the distribution device) to see if any obvious disturbance has

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occurred since rough-in. Some phones might not work with polarity reversed, so be particularly careful to check the wire colors for proper polarity.

- If no fault is obvious, re-test as for rough-in.

Take Note: If dial tone is not available, perform the same tests as for rough-in before the jacks were installed. A splitting adapter may be necessary to test each line of each jack. A toner can be used with a normal telephone or buttset to test for dial tone. Most toners will provide an audible tone to the phone as well as sufficient voltage to power the phone to generate touch-tone or rotary dial digits.

Coaxial Cabling Tests

Be sure connections at coax splitters are sound. Coaxial cable can be tested for continuity between the SMC and the termination point. Connecting a small, portable TV set to each video F-connector jack will indicate cable continuity and whether signal level is adequate. A snowy picture is an indication that signal level is too low. Make sure that all connections are hand tight. You may need to add a video amplifier to correct the problem. If your picture shows several wavy lines and “ghosts images” in the picture, check to make sure that all terminations without equipment attached have the 75 ohm termination caps in place.

Handheld coaxial cable testers are available from several manufacturers to simplify the above testing.

10.7 Speaker Cabling Tests

Testing of installed whole house speaker system:

Testing of the whole house audio system must be performed before connecting the amplifier but after all speaker and volume connections are complete. To perform this test, conduct a walk-through of the house and turn all of the volume controls to their highest setting. If using the Digital Volume Control, power must be applied to all of the volume control hubs before testing.

After the above steps are complete, the next step will be to measure the impedance of the load. The signal that the speaker wiring and associated equipment work with is on is a low level AC voltage. Impedance is the resistance to an AC load and is often slightly higher than the DC resistance that most multimeters measure. It is therefore important that the meter which is used is capable of measuring speaker impedance. One such tool is the Audioplex "Impedicator".

Connect the meter leads to the jack that the amplifier will be connected to. Test both left and right connections. The measurement must fall into the range of the capabilities of the intended amplifier. This range will be printed on the back of the amplifier near the speaker terminals or in the specifications section of the amplifiers owners manual. Do not connect the speaker system if the measured load is below the range of the amplifier or damage to the amplifier is likely. If the measurement is more than twice the highest number in the amplifier's impedance range, double check the settings on any analog volume controls and be sure that all of the volume controls are at their maximum settings. It is fine to have the system impedance slightly higher than the range of the amplifier, but if it is too high, the customer will experience diminished volume output.

If analog volume controls are installed in the home, changing the system impedance is fairly simple. To increase the total system impedance, turn the tap settings in the smallest rooms to the next highest setting (see the volume control instruction sheet for details on this operation) then re-check the system load at the amplifier location. This should correct any issues. If the impedance does not change after increasing the tap settings, you may have a short in the line.

Isolate suspected shorts or opens by disconnecting each volume control one at a time from the 1X6 passive audio module until the problem is found.

When testing shows that the amplifier will see a load in the acceptable range as discussed above, record the final reading in your paperwork and connect the amplifier. Before you power on the amplifier, be sure to turn the volume in all of the rooms down to about 1/3rd volume. Set the volume on the amplifier to zero and power it on. Select a source for testing (use a known good source such as a CD player and a familiar CD, as a familiar CD makes testing easier). Slowly turn up the volume on the amplifier until it is at about 1/2 maximum. You should now hear the source playing softly. Do not attempt to play things loudly now as the amplifier could be pushed to distortion with the room volume controls at 1/3rd. Now walk through the house and turn up the volume control in each room. Momentarily turning the volume to maximum in each room will show any flaws in the room such as loose screws on the speaker mounts or debris in the speaker. Now turn the volume back down and proceed to each room repeating the test.

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10.8 Documentation of Test Results

As we've mentioned, you should record your results as you complete each test. Use the forms provided at the end of this chapter to right in your results by hand, or, if using a Category 5 or 5e tester, use the built-in database for recording your data. Note: The cable name or number, from the label on the cable must be entered into the tester or the form to coincide with the test on that cable run.

Record the results of the test, pass or fail, with a print out and/or by checking the appropriate column opposite the cable run under test.

There may be special circumstances you want to record, such as a short, break, miswire or some other condition in the Notes column.

You must sign and date the form when you complete each page.

The test forms and/or files from the Category 5 or 5e tester are valuable information and prove to the builder, homeowner and others that you have completed your installation satisfactorily. The test documentation by cable run is a mandatory part of your Leviton Integrated Networks Certified System procedure on the installation. Submit all testing results forms and files to Leviton at the address, fax, or e-mail address indicated on the forms.

✂ (Cut along dotted line and mail bottom portion to Leviton)

Completion of Sign-Off and Certification Form

We certify that this structured media system installation has been installed, tested, and recorded according to Leviton certification procedures and practice for Leviton Integrated Networks platforms, systems, and components, and the cable manufacturer's warranty for the installed cable.

Residence Location _____

Address _____

City, State, Zip _____

Installation Company _____

Business Address _____

City, State, Zip _____

Phone Number _____

Installer Name _____

Signature _____ **Date** _____

☐☐☐☐☐☐☐ Please use the number to the left when calling for service or warranty information.

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Test Documentation Form for Bridged, Power, and Audio Cable Connections

			Test Results				
			Shorts		Continuity		
Cable Number	SMC Termination	Wallplate Location	Pass	Fail	Pass	Fail	Notes

Submit this Test Results Form to Leviton Manufacturing Co., Inc. at:
Address: 2222-222nd St. S.E., Bothell, WA 98021
Fax No.: 425-485-0112
E-mail: info@levitonvoicedata.com

Installer Signature:_____ Date:_____

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Test Documentation Form for Category 5 or 5e Links

			Test Results		
Cable Number	SMC Termination	Wallplate Location	Auto Test		Notes
			Pass	Fail	

Submit this Test Results Form to Leviton Manufacturing Co., Inc. at:
Address: 2222-222nd St. S.E., Bothell, WA 98021
Fax No.: 425-485-0112
E-mail: info@levitonvoicedata.com

Installer Signature:_____ Date:_____

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GLOSSARY

A

Amplifier A component that boosts the strength of a transmitted analog signal as measured in decibels (dB); an amplifier is similar to a repeater in digital systems

Amplitude The distance between high or low points of a waveform or signal. Also referred to as wave "height".

Amplitude Modulation A deliberate change in the amplitude of radio waves in order to transmit sound or visual images

Analog A method of transmitting information by a continuously variable electrical signal

ATM Asynchronous Transfer Mode. A high bandwidth, low delay, packet-like switching and multiplexing technique. Usable capacity is segmented into fixed-size cells, consisting of header and information fields. In an ATM data transmission, characters are sent at irregular intervals with each character including a start bit at the beginning and a stop bit at the end so the computer can identify and distinguish each character

Attenuation The decrease in the power of a signal, light beam, or light wave as they pass through a transmission medium. Measured in decibels. Attenuation is the opposite of gain. Attenuation often increases with frequency, cable length, and the number of connection in a circuit.

Architecture The way that a system (hardware, software, and the network) is structured and its components fit together,

AWG American Wire Gauge. Standard measuring gauge for non-ferrous conductors (i.e., non-iron and non-steel). Gauge is a measure of the diameter or cross sectional area of the conductor (the thickness of the cable)

B

Backbone Wiring The physical/electrical interconnections between telecommunications closets and equipment rooms. Cross-connect hardware and cabling in the Main and Intermediate Cross-Connects are considered part of the backbone wiring. The backbone is the more permanent part of a communications network and it carries most of the traffic.

Bandwidth The difference between the highest and the lowest frequencies of a transmission channel (path for information transmission). Identifies the amount of data that can be sent through a given channel. Measured in Hertz (Hz or cycles per second); higher bandwidth numbers mean higher data capacity.

Bend Radius (Fiber) Radius of curvature that a fiber can bend without breaking. Also see Cable Bend Radius

BICSI (Building Industry Consulting Service International) BICSI is a non-profit industry association concerned with promoting correct methods for all aspects of the installation of communications wiring

Binary Digit The basic unit of data that has a value of zero or one. Also known as a bit

BIT/S Bits per second. A measure of speed or data rate. Abbreviated as BPS. Larger measurements include Kbps (kilo or thousands of bits per second) and Mbps (mega or millions of bits per second).

BNC A connector used to terminate coaxial cables. BNC stands for Bayonet-Neill-Concelman.

Broadband Sufficient bandwidth to carry multiple voice, video or data channels simultaneously.

Bus A network topology in which nodes are connected to a single cable with terminations at each end

C

Cable Assembly A fixed length of cable with connectors installed on both ends. Sometimes called a Patch Cord, or Patch Cable.

Cable Bend Radius The amount of bend that can occur before a cable may sustain damage or increased attenuation.

Category 3 CAT3 A Category of Performance for inside wire and cable systems. Commonly used for voice applications and data to 10 Mbps. Defined by FCC Part 68, ANSI/EIA/TIA-568, TIA TSB-36 and TIA TSB-40.

Category 5 CAT5 A Category of Performance for inside wire and cable systems. Used in support of voice

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and data applications requiring a carrier frequency of up to 100 MHz. Now the most common cabling being installed for LAN connectivity. Defined by FCC Part 68, EIA/TIA-568, TIA TSB-36 and TIA TSB-40.

Category 5e (Enhanced) CAT5e A Category of Performance for inside wire and cable. Used in support of signaling rates of up to 100MHz over distances of up to 100 meters. Calls for tighter twists, electrical balancing between pairs and fewer cable anomalies. CAT5e is intended to support 100Base-T, ATM and Gigabit Ethernet.

Category 6 CAT6 A developing cable standard for UTP (Unshielded Twisted Pair) intended to support signaling rates up to 200 MHz. Applications will include 100Base-T, ATM and Gigabit Ethernet and wiring under development.

CATV Community Antenna Television. A broadband system that transmits signals from a central antenna throughout a community via coaxial cable

CCTV Closed circuit television in which the broadcast is sent to a limited number of locations, such as in a security system.

Channel The end-to-end transmission path between two points at which application-specific equipment is connected in a data system. A tunable frequency carrying audio and/or video signals on a modulated carrier.

Coaxial Cable A cable composed of an insulated central conducting wire wrapped in another cylindrical conductor (the shield). The whole thing is usually wrapped in another insulating layer and an outer protective layer. A coaxial cable has great capacity to carry vast quantities of information. It is typically used in high-speed data and CATV applications.

Compliance A wiring device that meets all characteristics of a standard is said to be in compliance with that standard.

Conductor Any substance, usually a wire or cable, that can carry an electrical current.

Connecting Block Also called a terminal block, punch-down block, quick-connect block, or crossconnect block. A plastic block containing metal wiring terminals to establish connections from one group of wires to another. Usually each wire can be connected to several other wires in a bus or common arrangement. There are several types of connecting blocks: 66 clip, BIX, Krone, 110, etc. A connecting block has insulation displacement connections (IDCs), which means you don't have to remove insulation from around the wire conductor before you "punch it down" (terminate it).

Connector A device that connects wires or fibers in cable to equipment or other wires or fibers. Wire and optical connectors most often join transmission media to equipment or cross connects. A connector at the end of a telephone cable or wire is used to join that cable to another cable with a mating connector or to some other telecommunications device.

Crossconnect Distribution system equipment used to terminate and administer communication circuits. In a wire crossconnect, jumper wires or patch cords are used to make circuit connections. In an optical crossconnect, fiber patch cords are used. The crossconnect is located in an equipment room, riser closet, or satellite closet.

Crosstalk See Near-End Crosstalk.

D

Daisy Chain In telecommunications, a wiring method where each telephone jack in a building is wired in series from the previous jack. Daisy chain is NOT the preferred wiring method, since a break in the wiring would disable all jacks "downstream" from the break. See also Home Run.

dB (Decibel) A dB is a unit of measure of signal strength, usually the relation between a transmitted signal and a standard signal source. Every 3 dB equals 50% of signal strength, so therefore a 6 dB loss is a loss of 75% of total signal strength.

Demarcation Point The point of interconnection between telephone Company terminal equipment and your building wiring. The protective apparatus or wiring at a subscriber's premises.

Demodulation The process of extracting the information signal from an analog carrier signal. Demodulation is the reverse of modulation. Examples include television and radio "Tuners".

Device As distinguished from equipment. In telecommunications, a "device" is the physical interconnection outlet. Equipment (a computer, phone, fax machine, etc.) then plugs into the device. See also Equipment and Plug.

Distribution Device A facility located within the dwelling unit for interconnection or cross connection.

Drop Another term for a cable run to a media location (e.g., video drop, telephone drop).

Drop Wire Outside wire pair(s) from the telco plant (cable), to a house or building for connection to a protector.

DTMF Acronym for Dual Tone, Multi-Frequency. See Tone Dial.

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E

Electronic Industries Association/Telecommunications Industries Association A trade organization of manufacturers which set standards for use of its member companies. Many associations fall under the umbrella of EIA, though it has recently been absorbed by the TIA, or Telecommunications Industry Association. See www.eia.org or www.tiaonline.org.

Electromagnetic Interference (EMI) The interference in signal transmission or reception caused by the radiation of electrical and magnetic fields.

Equipment As distinguished from Device. Telecom equipment (computers, phones, faxes, etc.) plugs into telecommunications outlets or devices. See also Device.

Epoxy Connector A type of fiber optic connector that requires a Chemical bond, or epoxy.

Ethernet A type of local area network used for connecting computers, printers, workstations, terminals, etc. within the same building. Ethernet is a physical link and data link protocol that operates over twisted pair wire and over coaxial cable at speeds greater than 1 Gbps. Ethernet LANs are being promoted by DEC, Intel and Xerox. Compare with Token Ring.

F

FDDI Fiber Distributed Data Interface FDDI is a 100 Mbps fiber optic LAN. It is an ANSI standard. It uses a "counter-rotated" Token ring topology. An FDDI LAN is typically known as a "backbone" LAN. It is used for joining file servers together and for joining other LANS together.

Fiber Optics High bandwidth communication medium in which communication signals are transmitted in the form of light beams over glass optical fiber cables

Frequency Modulation Radio transmission in which the frequency of a sine wave signal is varied so it can carry information. Abbreviated as FM

G

Gain The increase in signaling power that occurs as the signal is boosted by an electronic device. Measured in decibels (dB).

Gauge Refers to the diameter of wire. The higher the gauge number, the thinner the wire's diameter and the higher its resistance.

H

Headroom (also called Overhead or Margin) The number of decibels by which a system exceeds the minimum defined requirements. The benefit of headroom is that it reduces the bit-error rate (BER), and provides a performance 'safety net' to help ensure that current and future high speed applications will run at peak accuracy, efficiency and throughput.

Hertz A unit of frequency equal to one cycle per second. Abbreviated as Hz.

Home Run Phone system wiring where the individual cables run from each phone directly back to the central switching equipment. Home run cabling can be thought of as "star" cabling. Every cable radiates out from the central equipment. All PBXs and virtually all key systems work on home run cabling. Some local area networks work on home run wiring. See also Star Wiring, Daisy Chain.

Hub The point on a network where circuits are connected. Also, a switching node. In Local Area Networks, a hub is the core of a star as in ARCNET, StarLAN, Ethernet, and Token Ring. Hub hardware can be either active or passive. Wiring hubs are useful for their centralized management capabilities and for their ability to isolate nodes from disruption.

Hybrid Connector A connector containing both optical fiber and Electrical conductors.

I

Insulation Displacement Connection (IDC) A type of wire termination Where wire is "punched down" into a metal holder which cuts into the Insulation wire and makes contact with the conductor, causing the electrical connection to be made.

IDF Intermediate Distribution Frame A metal rack designed to connect cables and located in an equipment room or closet. Consists of components that provide the connection between inter-building cabling and the intra-building cabling, i.e. between the Main Distribution Frame (MDF) and individual phone wiring. There's usually a permanent, large cable running between the MDF and IDF. The changes in wiring are done at the IDF. This saves confusion in wiring.

IEEE 802.3 IEEE stands for the Institute of Electrical and Electronic Engineers, a publishing and standards-making body responsible for many standards used in LANs, including the 802 series. Ethernet and StarLan

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both follow the 802.3 standard. Typically they transmit at 10 megabits per second. This is the most common local area network specification.

Impedance The total opposition (i.e. resistance and reactance) a circuit offers to the flow of alternating current. It is measured in ohms, and the lower the ohmic value, the better the quality of the conductor.

Interconnect 1. A circuit administration point, other than a crossconnect or an information outlet, that provides capability for routing and rerouting circuits. It does not use patch cords or jumper wires, and typically is a jack-and-plug device used in smaller distribution arrangements or that connects circuits in large cables to those in smaller cables. 2. An Interconnect Company is one which sells, installs, and maintains telephone systems for end users, typically businesses.

ISDN Integrated Services Digital Network. According to AT&T, today's public switched phone network has many limitations; ISDN's vision is to overcome these deficiencies.

J

Jack A receptacle used in conjunction with a plug to make electrical contact between communication circuits. Jacks and their associated plugs are used in a variety for connecting hardware applications including cross connects, interconnects, information outlets, and equipment connections. Jacks are used to connect cords or lines to telephone systems. A jack is the female component of a plug/jack connector system, and may be standard, modified, or keyed.

L

LAN Local Area Network. A short distance network (typically within a building or campus) used to link together computers and peripheral devices (such as printers) under some form of standard control.

Link A transmission path between two points, not including terminal equipment, work area cables, and equipment cables

Loop 1. Typically a complete electrical circuit. 2. The loop is also the pair of wires that winds its way from the central office to the telephone set or system at the customer's office, home or factory (i.e., 'premises' in telephony terms).

Loopback A diagnostic test in which a transmitted signal is returned to the sending device after passing through a data communications link or network. This test allows the comparison of a returned signal with the transmitted signal.

M

Mbps MegaBits Per Second. One million bits per second. (Different from MBps, or a million bytes per second.)

MDF Main Distribution Frame. A wiring arrangement which connects the telephone lines coming from outside on one side and the internal lines on the other. A main distribution frame may also carry protective devices as well as function as a central testing point.

MHz Megahertz. A unit of frequency denoting one million Hertz (i.e., 1,000,000 cycles per second).

MMJ Modified Modular Jack. A six-wire modular jack with the locking tab shifted off to the right hand side. Used in the DEC wiring system.

Modular Equipment is said to be modular when it is made of "plug-in units" which can be added together to make the system larger, improve the capabilities, or expand its size.

Modem A device that converts digital signals to analog signals for transmission over (usually analog) phone wires. Stands for modulator-demodulator.

Mud Ring The recommended low-voltage mounting bracket.

Multimedia Applications that communicate information by more than one means.

N

Near-End Crosstalk (NEXT) Electrical noise coupled from one pair of wires to another within a multi-pair cable.

Network A network ties things together. Computer networks connect all types of computers and computer- related things— terminals, printers, modems, door entry sensors, temperature monitors, etc. The networks we're most familiar with are long distance ones, like phones and trains. Local Area Networks (LANs) connect computer equipment within a building or campus.

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O

Off-Hook When the handset is lifted from its cradle, it's off-hook. The term originated when the early handsets were actually suspended from a metal hook on the phone. In modern phones, when the handset is removed from its hook or cradle, it completes the electrical loop, thus signaling the central office to provide dial tone.

On-Hook When the phone handset is resting in its cradle. The phone is not connected to any particular line. Only the bell is active—i.e., it will ring if a call comes in. Opposite of Off-Hook.

Open (Fault) Means that the circuit is not complete or the cable/fiber is broken.

Ohm A unit of electrical resistance. The higher the value, the greater the resistance.

Outlet A telecommunications outlet is a single-piece cable termination assembly (typically on the floor or in the wall), containing one or more modular telecom jacks. Such jacks might be RJs, coaxial terminators, fiberoptic couplers, etc. See also Device and Equipment.

P

Part 68 Requirements Specifications established by the FCC as the minimum acceptable protection communications equipment must provide the telephone network.

Patching A means of connecting circuits via cords and connectors that can be easily disconnected and reconnected at another point. May be accomplished by using modular cords connected between jack fields or by patch cord assemblies that plug onto connecting blocks.

PBX Private Branch Exchange. A small, privately-owned version of the phone company's larger telephone central switching office.

Performance Compare with Compliance. A device can exhibit performance characteristics without being compliant to an industry standard.

Plenum An interior air duct through which cables can be housed.

Plug A male component of a plug/jack connector system. In premises wiring, a plug provides the means for a user to connect communications equipment to the communications outlet.

Point-to-point Transmission An uninterrupted connection between two pieces of equipment.

Polarity Which side of an electrical circuit is the positive? Which is the negative? Polarity is the term describing which is which.

POTS Plain Old Telephone Service. The basic service supplying standard single line telephones, telephone lines and access to the public switched network. Just receive and place calls. No added features like Call Waiting or Call Forwarding.

Power Sum A test method for four pair cable whereby the mathematical Sum of pair-to-pair crosstalk from three pairs to one pair is measured.

Pre-Configured Structured Cabling Panels Leviton hardware that combine various distribution modules onto single-installation panels.

Premises Telephony term for the space occupied by a customer or authorized/joint user in a building(s) on continuous or contiguous property (except railroad rights of way, etc.) not separated by a public road or highway.

Premises Wiring System The entire wiring system on the user's premises, especially the supporting wiring that connects the communications outlets to the network interface jack.

Punch Tool A spring-loaded tool for cutting and connecting wire in a jack or module

R

RBOC Regional Bell Operating Company. Seven RBOCs exist, each of which owns two or more Bell Operating Companies (BOCs). The RBOCs were carved out of the old AT&T/Bell System during the divestiture of the Bell operating companies from AT&T in 1984.

RCDD The RCDD (Registered Communications Distribution Designer) title is a professional rating granted by BICSI (the Building Industry Consulting Service International). RCDDs have demonstrated a superior level of knowledge of the telecommunications wiring industry and associated disciplines.

Return Loss A measure of the similarity of the impedance of a transmission line and the impedance at its terminations. It is a ratio, expressed in decibels, of the power of the outgoing signal to the power of the signal reflected back.

Ring As in Tip and Ring. One of the two wires needed to set up a telephone connection. See Tip.

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RJ Registered Jack. RJs are telephone and data jacks/applications registered with the FCC. Numbers, like RJ-11, RJ-45, etc. are widely misused in the telecommunications industry. A much more precise way to identify a jack is to specify the number of positions (width of opening) and number of conductors. Example: “8-position, 8-conductor jack” or “6-position, 4-conductor jack”.

S

Series Wiring See Daisy Chain.

Service Loop When a device is terminated to the wire in the communications outlet, a fair amount of “slack” should be left on the wire and wound in the box to accommodate future trimming when devices are changed out.

Splice The joining of two or more cables together by connecting the conductors pair-to-pair.

Standards Agreed principles of protocol. Standards are set by Committees working under various trade and international organizations.

Star Wiring/Star Topology See Home Run.

Structured Media Center Leviton’s central distribution center for structured cabling. Also known as an SMC.

Surge Suppression The prevention of voltage surges from reaching and damaging electronic equipment

T

T1 A standard for digital transmission in North America. A digital transmission link with a capacity of 1.544 Mbps (1,544,000 bits per second.) T1 lines are used for connecting networks across remote distances. Bridges and routers are used to connect LANs over T1 networks.

Talk Battery The DC voltage supplied by the central office to the subscriber’s loop, which allows voice conversation.

TCP/IP A set of protocols developed by the Department of the Defense to link dissimilar computers across many kinds of networks.

Telco An Americanism for TELephone COmpany.

Ten Base-T See10Base-T at end of Glossary.

Terminate To connect a wire conductor to something, typically a piece of equipment.

TIA Telecommunications Industry Association. A trade organization of manufacturers which sets standards for use of its member companies. Formerly fell under the umbrella of EIA, (Electronic IndustriesAlliance). See www.tiaonline.org.

Tip 1.†The first wire in a pair of wires. (The second wire is called the “ring” wire.) 2.†A conductor in a telephone cable pair which is usually connected to positive side of a battery at the telco. It is the phone industry’s equivalent of Ground in a normal electrical circuit. See Ring.

Tone Dial A push-button telephone dial that makes a different sound (in fact, a combination of two tones) for each number pushed. The technically correct name for tone dial is Dual Tone Multi Frequency, or DTMF.

Token Ring A ring topology for a local area network (LAN) in which a supervisory frame, or token, must be received by an attached terminal or workstation before that terminal or workstation can start transmitting. The workstation with the token then transmits and uses the entire bandwidth of whatever communications media the token ring network is using. A token ring can be wired as a circle or a star, with the workstations wired to a central wiring center, or to multiple wiring centers. The most common wiring scheme is called a star-wired ring. Whatever the wiring, a token ring LAN always works logically as a circle, with the token passing around the circle from one workstation to another. The advantage of token ring LANs is that media faults (broken cable) can be fixed easily, since it’s easy to isolate the faults. Token rings are typically installed in centralized closets, with loops snaking to served workstations.

Topology As in network topology. The geometric physical or electrical configuration describing a local communication network; the shape or arrangement of a system. The most common topologies are the bus, ring, and star.

TP-PMD Twisted Pair Physical Media Dependent. Technology under review by the ANSI X3T9.5 working group that allows 100 Mbps transmission over twisted-pair cable.

Twisted Pair Two insulated copper wires twisted around each other to reduce induction (thus interference) from one wire to the other. The twists, or lays, are varied in length to reduce the potential for signal interference between pairs. Several sets of twisted pair wires may be enclosed in a single cable. In cables greater than 25 pairs, the twisted pairs are grouped and bound together.

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U

UL Underwriters Laboratories, a privately owned company that tests to make sure that products meet safety standards. UL also administers a program for the certification of Category-Rated Cable.

Universal Service Order Code An old Bell system term identifying a particular service or equipment offered under tariff.

UTP Unshielded Twisted Pair. See Twisted Pair.

W

Workstation The working area in a building required by one telecommunications user. Industry standards call for one voice drop and one data drop for each workstation. The voice drop is one 4-pair unshielded twisted pair (UTP). The data drop may be 100 4-pair UTP 150 2-pair shielded twisted pair (STP), or optical fiber.

10BASE-T This is the IEEE standard that defines the requirement for sending information at 10 Mbps on unshielded twisted-pair cabling, and defines various aspects of running Ethernet on this cabling.

100BASE-T This is the IEEE standard that defines the requirement for sending information at 100 Mbps on unshielded twisted-pair cabling, and defines various aspects of running baseband Ethernet on this cabling.

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APPENDIX B:

Frequently Asked Questions

1. Why should I install Leviton's Integrated Networks rather than assembling my own from off-the-shelf components?

Leviton offers a single, convenient package of tested materials that meet commercial grade requirements. They are designed to work together without conflicts. They are also, in part, simple plug and play architecture that makes the installer's job easier. The most popular structured cable functions are brought together in our Pre-Configured Structured Cabling Panels that conveniently meet most system requirements. Panels and components can easily be combined to build even larger systems. Leviton offers easy to use, compatible components, and a certified training program for installers, which many of your clients will find reassuring.

2. Why should I bother becoming a certified installer and get my Leviton Integrated Networks Certified System certificate?

The certification program will help you install the Leviton Integrated Network platforms and application subsystems according to best practices and will enable the homeowner to receive years of problem free service from the completed installation. Your certificate is proof that you have completed training and have demonstrated satisfactory understanding of the ANSI/TIA/EIA-570A Residential Structured Wiring Standard and Leviton installation, documentation, testing, and registration practices. Use your certificate to indicate to your builder customer that you are a certified installer.

A summary of the advantages are:

- The Certification Program provides a structure in which the individual and otherwise standalone pieces of a structured cabling system are combined seamlessly for the end user.
- The Program benefits the end user with a quality installation and quality support.
- The program benefits the installation company by providing access to high quality products and system certification, as well as factory training and technical support, to offer to its customers.
- Many builders will require the certificate.
- Applications Assurance and TEN YEAR Extended Warranty.
- Training in industry standards and installation practices.
- Access to the latest standards developments information.
- Technical support from Leviton applications engineers and RCDD's.
- Joint Leviton promotional materials and opportunities.
- Ability to bid jobs requiring certified installers.
- Promotion of the certification program and Program Partners to end users and designers.
- Lead referrals

3. I've always used electrical boxes. Why do you recommend mud rings for cable termination and device installation?

A mud ring gives the installer easy and ready access to the stud cavity and allows for a long service loop to be left in the wall without damaging the cable. Remember, low-voltage cable has to be handled more carefully than AC cable. Cable pinching can occur with a box,. Stuffing the cable in a box is not recommended since cable kinks can occur which impact the cable performance.

4. Why can't I push my Category 5 or 5e cable into a jack or distribution module with my screwdriver and clip the ends off with a wire cutter?

Category 5 or 5e's twisted pairs are made from a small gauge wire (usually 24). It can easily be damaged with the wrong tools and the system that depends on the Category 5 or 5e might not operate properly. The proper tool to use is a punchdown/termination tool .

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5. Why not use Category 3 cable when it will satisfy the job requirements?

Leviton recommends Category 5 or 5e for all low-voltage installations because of its greater carrying capacity that is more suited to current and future high-speed data applications. You're always better off installing a higher grade, Level 2 structured cable system as it is far more adaptable to system changes and additions.

6. I understand that I can use Category 5 or 5e cable instead of coaxial for video applications. Is this true?

You can use Category 5 or 5e UTP for video distribution with suitable adaptive devices. You might need coax-to-UTP converters at both ends of the cable run. However, it is far simpler from an installer and troubleshooting standpoint to for each system to employ its respective cabling.

7. Should I be installing optical fiber cable instead of Category 5 or 5e? It seems that this is the direction future installations are headed.

Fiber optic applications are not currently in common use in residential systems. You are correct that this is the likely direction for future application. As a cost savings, optical fiber cable can be run and terminated at wallplates with service loops stored in the walls. Another option is to run conduit with pull strings installed to various room locations and leave the cable for later use. Leviton will be addressing optical fiber installation in a later update to this manual.

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Installation Manual for Residential Structured Wiring

www.leviton.com/lin
www.levitonvoicedata.com

Tech Line: 800-722-2082
Customer Service: 800-323-8920

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